

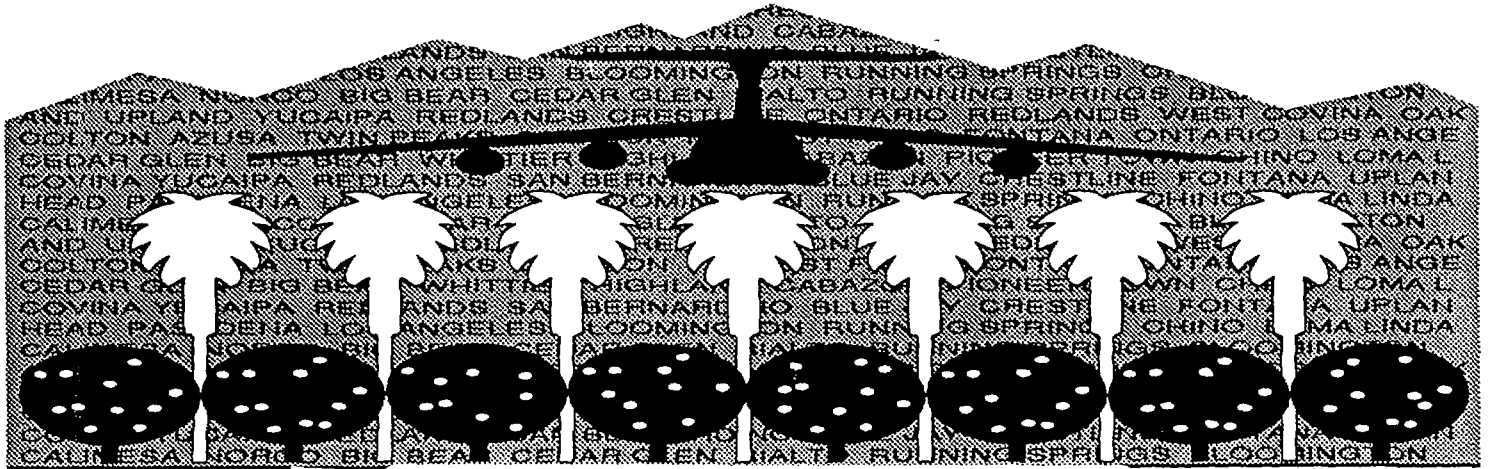
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NORTON AIR FORCE BASE

3093-00108

**CENTRAL BASE AREA
OPERABLE UNIT****RECORD OF DECISION**

United States Air Force Headquarters
Air Force Base Disposal Agency
Norton Air Force Base
California 92409

**NORTON AIR FORCE BASE
CENTRAL BASE AREA OPERABLE UNIT
SAN BERNARDINO, CALIFORNIA**

RECORD OF DECISION

U.S. Air Force Headquarters
Air Force Base Conversion
Agency
Norton Air Force Base
California 92409

24 NOVEMBER 1993

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ACRONYMS

AF	Air Force
AFB	Air Force Base
ARARs	Applicable or Relevant and Appropriate Requirements
BACT	Best Available Control Technology
BDAT	Best Demonstrated Control Technology
bgs	below ground surface
CAL-EPA	State of California Environmental Protection Agency
CBA	Central Base Area
CBA OU	Central Base Area Operable Unit
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cy	cubic yards
DOD	Department of Defense
ENR CCI	Engineering News Review Construction Cost Index
FFA	Federal Facility Agreement
FS	Feasibility Study
ft	feet
GAC	Granular Activated Carbon
gpm	gallons per minute
hr	hour
IAG	Interagency Agreement
IRP	Installation Restoration Program
lb	pound
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
MW	Monitoring Well
NA	Not an ARAR
NCP	National Oil and Hazardous Substances Contingency Plan
NPL	National Priority List
O&M	Operation and Maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PP	Proposed Plan
ppb	parts per billion
ppm	parts per million
ppmv	parts per million by volume

ACRONYMS (Continued)

RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act
SCAQMD	South Coast Air Quality Management District
SDWA	Safe Drinking Water Act
SWCB	State Water Control Board
SVE	Soil Vapor Extraction
TBC	To Be Considered
TCE	Trichloroethylene
TCLP	Toxicity Characteristic Leaching Procedure
µg/L	micrograms per liter
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

DECLARATION

SITE NAME AND LOCATION

Norton Air Force Base
San Bernardino, California

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial actions for the Norton Air Force Base (AFB) Central Base Area (CBA) Operable Unit (OU) in San Bernardino, California. The CBA OU is one of several planned OUs to address overall site cleanup. The selected remedial actions for the CBA OU were chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations, (CFR) Part 300). This decision is based on information contained in the administrative record for this site.

The State of California concurs with the selected remedies.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this OU, if not addressed by implementing the response actions selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to the public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

The response actions address the documented principal public health and environmental threats from the CBA OU. This is the first of several OUs for overall site cleanup. The remaining OUs will address soil contamination and contaminated groundwater (excluding the on- and off-base trichloroethylene [TCE] contaminated groundwater plume of the CBA). Actions for the CBA OU have been selected to address the volatile organic compound (VOC)-impacted groundwater (both on- and offbase), and the TCE soil sources in the CBA.

The major components of the selected groundwater remedy include:

- Deed restrictions
- Groundwater monitoring
- Groundwater extraction
- Wellhead treatment or provision of water supplies
- Treatment by air stripping
- Direct discharge of emissions to atmosphere, or treatment by vapor-phase carbon adsorption if emissions are not in compliance with air quality Applicable or Relevant and Appropriate Requirements (ARARs)
- Reinjection of treated water.

The major components of the selected deep subsurface soil remedy for the MW90 Area and Building 763 include:

- Deed restrictions
- Groundwater monitoring
- Treatment by in situ soil vapor extraction (SVE)
- Treatment of emissions by vapor-phase carbon adsorption, or no treatment if emissions are in compliance with air quality ARARs.

The major components of the selected shallow subsurface soil (TCE only) remedies include:

Building 658

- Excavation of soil containing TCE above the cleanup standard
- Backfill of excavation with clean import or borrow soil
- Transportation onsite to treatment location
- Treatment by ex situ SVE
- Vapor-phase carbon adsorption of emissions, or no treatment if untreated emissions are in compliance with air quality ARARs
- Disposal onsite of treated soil.

Building 763

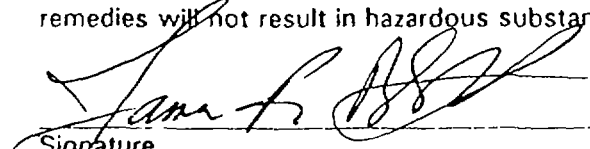
- Deed restrictions
- Groundwater monitoring
- Treatment by in situ SVE
- Vapor-phase carbon adsorption of emissions, or no treatment if untreated emissions are in compliance with air quality ARARs.

The major components of the selected shallow subsurface soils (TCE and chromium) remedy include:

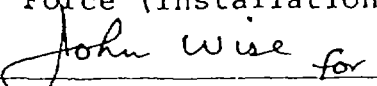
- Demolition and reconstruction of existing facilities
- Excavation of soil containing TCE and chromium commingled above the cleanup standards
- Backfill of excavation with clean import or borrow soil
- Testing of excavated soil
- Transportation of soil offsite by licensed transporter
- Disposal and treatment (if needed) offsite to a licensed disposal facility.

STATUTORY DETERMINATIONS

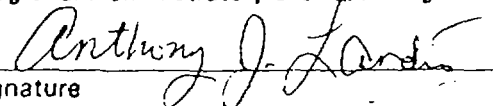
The selected remedies are protective of human health and the environment, comply with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and are cost-effective. The remedies use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and satisfy the statutory preference for remedies that employ treatment that reduce toxicity, mobility, or volume as a principle element. The groundwater remedy involves treatment estimated to take at least 30 years to achieve cleanup standards; the combined soil remedies will achieve the cleanup standards in approximately 2 years. Because the groundwater remedy will result in hazardous substance remaining onsite until the cleanup standards are met, the 5 year review will be conducted on an ongoing basis to ensure that the remedy continues to provide adequate protection of human health and the environment. The 5 year review does not apply to any of the soil remedies because the remedies will not result in hazardous substances remaining onsite above health-based levels.


Signature

Deputy Assistant Secretary of the
Air Force (Installations)


Signature

Regional Administrator, U.S. EPA Region IX


Signature

DSMOA Technical Program Manager, State of California
Department of Toxic Substances Control

9/24/93
Date

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1.0 SITE NAME, LOCATION, AND DESCRIPTION

1.1 LOCATION

Norton Air Force Base (AFB) (referred to herein as the "base" or "Site") is located in the city of San Bernardino, San Bernardino County, California, 55 miles east of Los Angeles and 60 miles west of Palm Springs (Fig. 1-1).

1.2 POPULATION

The population of San Bernardino County is 1,418,380 (U.S. Census, 1990), and consists of both english- and spanish-speaking citizens. The 1990 U.S. Census for Norton AFB indicated the population to be 653 persons, 70% of which are male.

1.3 LAND USE

Current Land Use. Current land use at Norton AFB is classified as residential and light industrial. Maintenance facilities, warehouses, and administrative centers support the mission.

Land surrounding Norton AFB includes areas of residences, light and heavy industry, and agriculture. Residential areas are located to the north and west. Light industrial areas are located to the north and to the southwest.

Future Land Use. Norton AFB is scheduled for closure by the Department of Defense (DOD) in 1994. The property will be classified for some residential and mostly light industrial use after disposal.

1.4 CLIMATE

The San Bernardino Valley is characterized by a semi-arid environment. The yearly average high is 78°F and the yearly low 49°F. The average annual rainfall at Norton AFB is 12.72 inches.

Prevailing winds at Norton AFB are from the northwest. Annual average wind speed from the west is 3 knots; maximum wind speed is 69 knots.

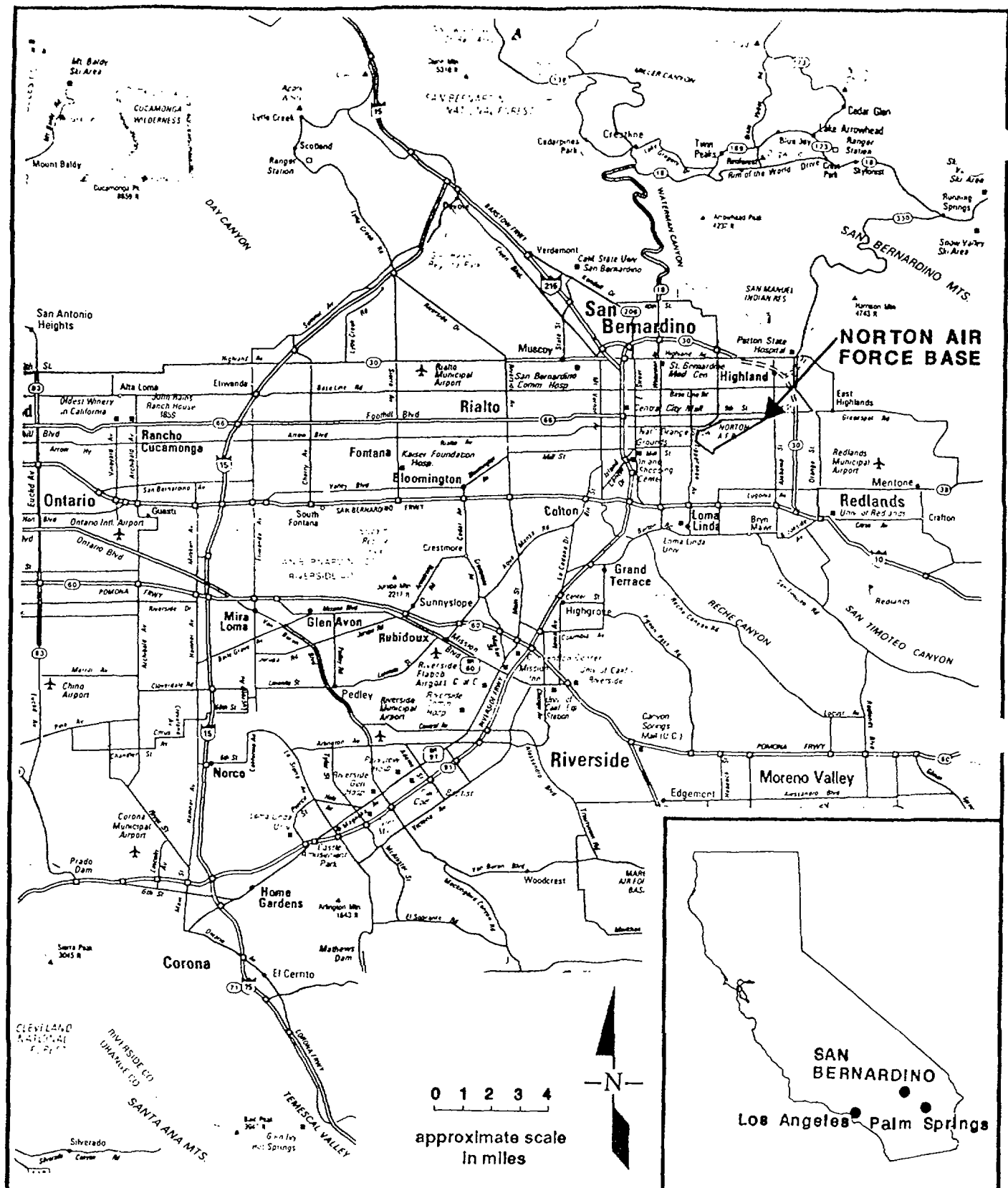
1.5 GEOLOGY

Norton AFB is located on a large apron of alluvium, characterized by great thickness, rapid facies changes, and a wide range of fragment sizes. The stratigraphy consists of unconsolidated water-bearing deposits underlain by consolidated, virtually non-water bearing rocks.

Sediments underlying Norton AFB consist of unconsolidated, relatively undisturbed gravels, sands, silts, and clays. The depositional setting varies across the base.

1.6 SOIL

Soils at Norton AFB consist of loamy sands and sandy loams. The soils are generally quite permeable and exhibit limited run-off and water erosion potential.



Regional Map Showing Location of Norton AFB

CDM FEDERAL PROGRAMS CORPORATION
a subsidiary of Camp Dresser & McKee Inc.

Figure No. 1

1.7 SURFACE WATER

The main surface water features near Norton AFB are City Creek, Warm Creek, the Twin Creek flood control channel, and the Santa Ana River. The Santa Ana River flows southwest along the southern base boundary.

Natural surface run-off flows into underground storm drains and natural surface drainages at Norton AFB. There are eleven discharge points.

1.8 HYDROGEOLOGY

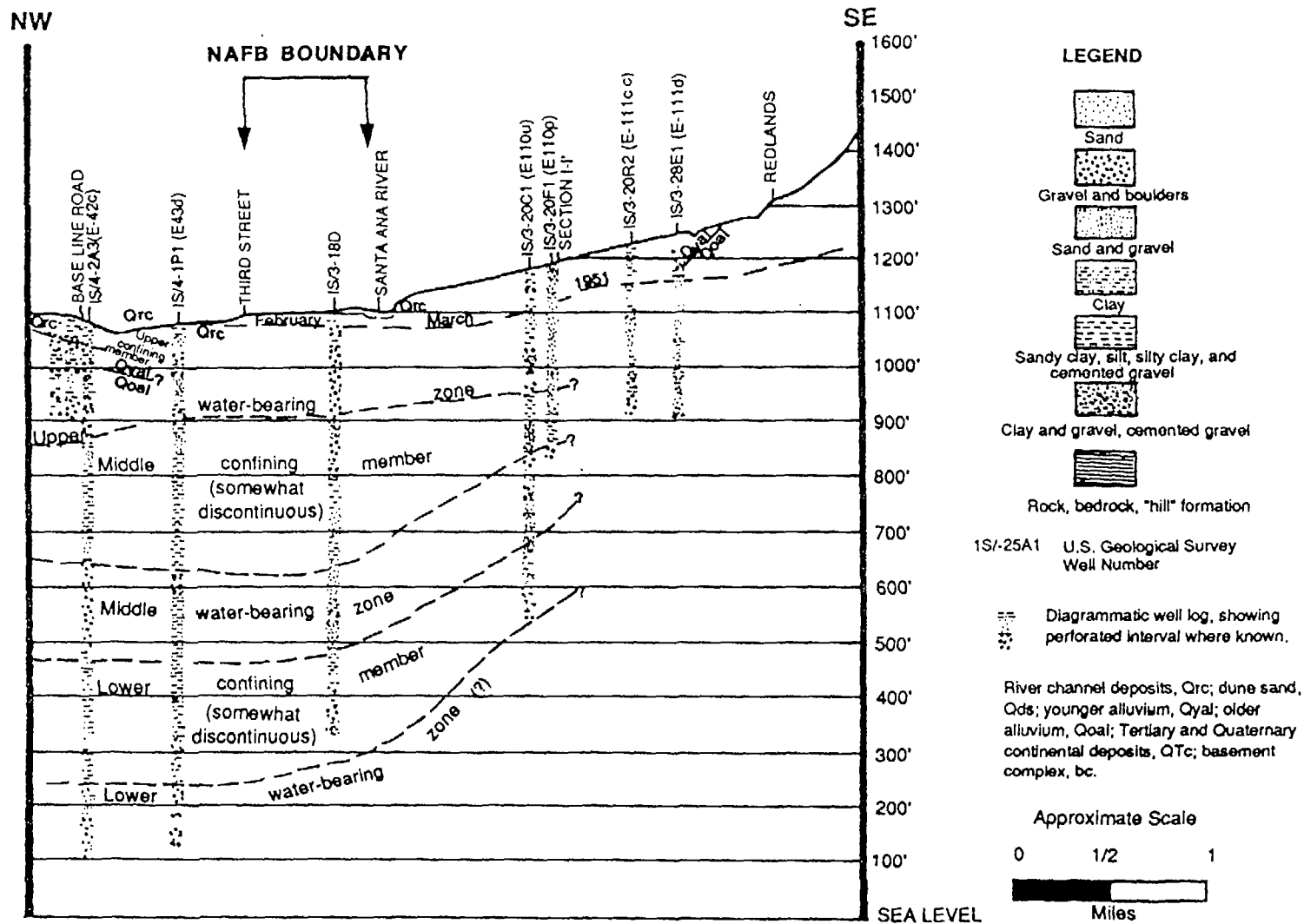
The groundwater aquifer system beneath Norton AFB is part of the Bunker Hill hydrologic basin that is defined by three water-bearing zones (the upper, middle, and lower) and three confining members (the upper, middle, and lower) (Fig. 1-2). The upper confining member, which locally supports perched water zones, covers all but the eastern half of the base. Regional groundwater flows towards the southwest. Recharge is supplied by runoff from the San Bernardino Mountains.

1.9 PRODUCTION WELLS

The aquifer system provides drinking water in addition to water for agricultural and commercial uses. The upper water-bearing zone has been affected by Norton AFB operations. Drinking water is derived principally from the middle and lower water-bearing zones. The Gage Canal complex, which consists of sixteen active wells located immediately south/southwest of the base (Fig. 1-3), has occasionally reported TCE in groundwater samples.

1.10 THREAT OF SITE

TCE was a common degreasing solvent used in industrial operations at Norton AFB from the 1940s through the early 1980s. Usage has affected localized soil which has affected local groundwater quality in the upper water-bearing zone of a drinking water aquifer. Also being addressed is the soil contaminated by chromium at site 9. The selected remedies address the principal threat from both TCE, TCE byproducts and or degradation (i.e., vinyl chloride), and chromium.

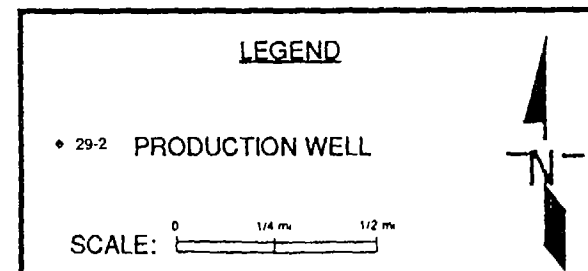
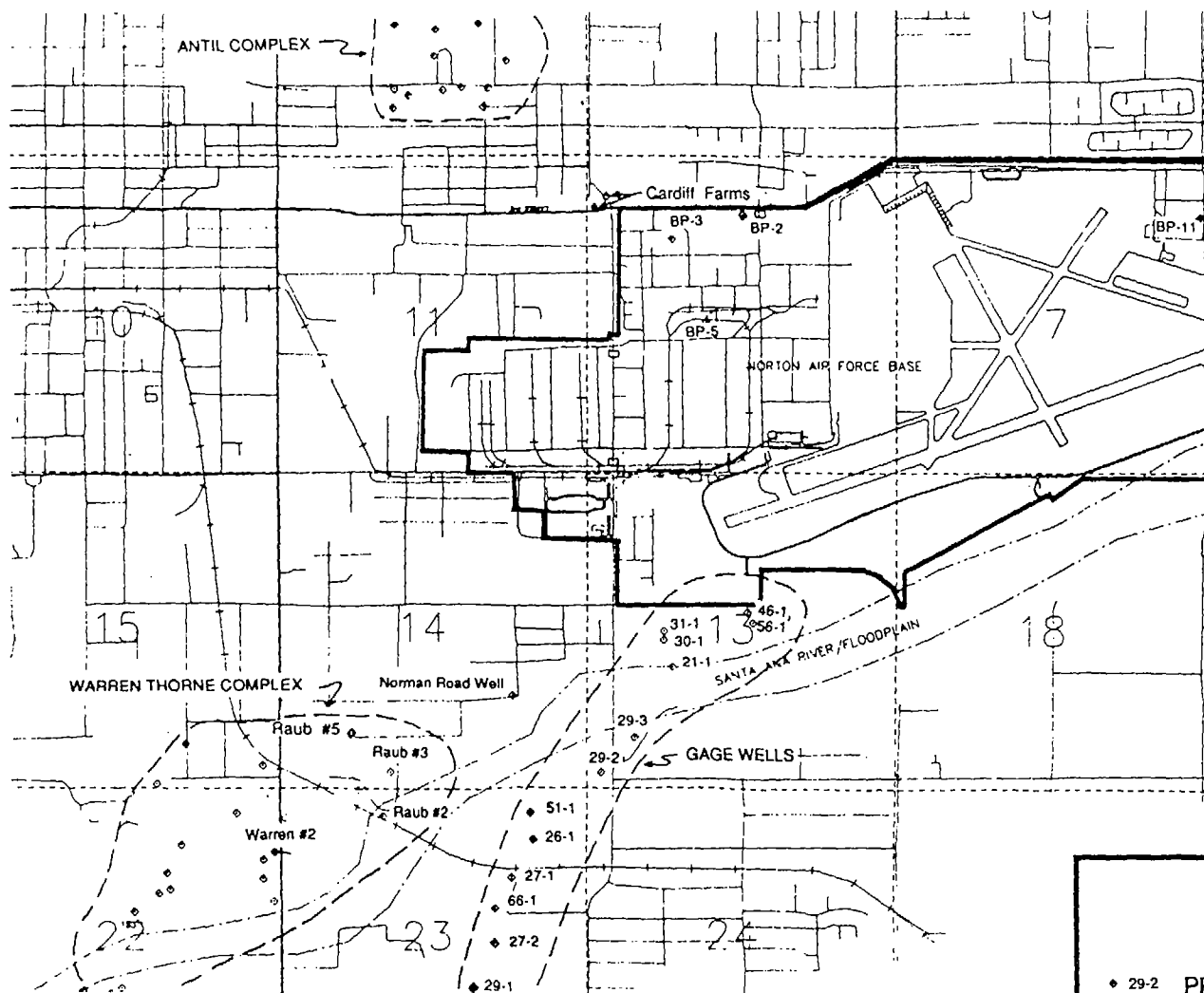


Source: Dutcher and Garrett, 1963.

Note: Numbers refer to USGS Well Identification Numbers.

NORTON AIR FORCE BASE

Hydrogeology of the Bunker Hill Basin



NORTON AIR FORCE BASE

Production Wells On and Near Norton AFB

Figure No. 1-3

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2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Norton AFB was activated in March 1942 as an engine repair center for Air Force (AF), U.S. Navy, and private industry aircraft. The base became a Military Airlift Command base in 1966. In 1968, the Aerospace Audiovisual Services established its headquarters at the base. Norton AFB currently provides airlift and sustenance capabilities for air and combat units world-wide but has been identified for base closure by DOD. The base will officially close March 31, 1994.

Solvents, specifically TCE, were used in servicing aircraft from the 1940s to the early 1980s¹. Former waste disposal, handling, and discharge practices have resulted in soil and groundwater contamination. A chronology of important site activities and investigations that support remedy selection for the CBA OU follows:

June 1980	DOD issues the Defense Environmental Quality Program Policy Memorandum 80-6 requiring the identification of hazardous waste sites.
October 1982	Norton AFB issues the Phase I Records Search. Twenty IRP sites of potential contamination are identified.
July 1985	Norton AFB issues the Phase II Problem Confirmation Study. Fifteen of the 20 identified IRP sites are investigated. Data indicate contamination at seven IRP sites. TCE is detected in groundwater.
August 1987	Norton AFB is placed on the United States Environmental Protection Agency's (USEPA) National Priorities List (NPL).
September 1987	Norton AFB issues the Phase II Confirmation/Quantification, Stage 2 Final Report. Eighteen of the 20 identified IRP sites are investigated. Two additional IRP sites are identified.
September 1988	Maximum TCE concentration detected (4,630 µg/L) in groundwater from monitoring well 90 (MW90). The area is identified as a suspected TCE source.
December 1988	Norton AFB issues the Stage 3 Final Report. Twenty-one of the 22 IRP sites are investigated.
June 1989	The AF signs the Norton AFB Federal Facility Agreement.
April 1990	Norton AFB formally designates the contaminated groundwater in the CBA and any contributing soil sources as the CBA OU.
November 1990	Norton AFB begins the CBA Groundwater Investigation to define the extent of the TCE groundwater plume.

¹ The Air Force stopped purchasing and distributing TCE in the early 1980s, but it is possible that existing supplies may have been used until they were exhausted.

March 1991	Norton AFB begins construction of a treatability test to evaluate groundwater pump and treat. The system is located downgradient of MW90.
June 1991	Norton AFB begins the TCE Source Investigation to locate and characterize soil sources that have contributed to the TCE in groundwater.
July 1991	Lockheed completes a removal action in which approximately 4,200 cubic yards (cy) of soil containing TCE is removed from Docks 3 and 4 in Building 763 during reconstruction of the dock floors. Building 763 is an identified TCE source area. The soil is treated onsite.
February 1992	Norton AFB issues the Draft Remedial Investigation (RI) Report (CBA Groundwater and TCE Source Investigation). The on-base plume is characterized, and four TCE soil source areas are identified: MW90 Area, Building 658, IRP site 9, and Building 763.
March 1992	Norton AFB issues the Draft Feasibility Study (FS) and the Draft Proposed Plan (PP).
June 1992	Norton AFB begins treatability testing of the groundwater pump and treat system, and characterizing the off-base portion of the plume.
August 1992	The AF, USEPA, and the California Environmental Protection Agency (Cal-EPA) enter into dispute resolution over the FS.
September 1992	The AF announced its intent to install an extraction system at the base boundary to impede further migration of the contaminated groundwater.
January 1993	Upon finalizing the FS and the PP, the AF, USEPA, and Cal-EPA agree to formally resolve the remaining dispute resolution items in the ROD.
February 1993	Norton AFB issues the Final FS and PP.

3.0 COMMUNITY PARTICIPATION

Norton AFB has conducted the following activities under the RI/FS process:

April 1990	Release of Community Relations Plan. Establish and notify community of the location of information repositories.
July 1990	Notification and request for participation in Community Relations Workshop to discuss the Community Relations Plans and ensure community involvement in the upcoming RI/FS.
September 1990	Release of Fact Sheet discussing planned field activities for the CBA Groundwater Investigation and TCE Source Investigation, the groundwater treatability study, and information on obtaining Technical Assistance Grants.
June 1991	Release of Fact Sheet discussing the RI, on-going investigations, the groundwater treatability study, the TCE Source Investigation, and information on how the public can become involved.
March 1992	Release of Fact Sheet informing visitors and base personnel of temporary access restriction necessary to perform the field work. Precautionary measures are recommended.
September 1992	Notice of intent to install groundwater extraction system at base boundary.
October 1992	Release of IRP update discussing the CBA Groundwater Investigation. The community is notified that the information is available in spanish.
February 1993	Release of the FS and PP for public comment. Public notice is placed in two local newspapers requesting public comments.
March 1993	Sponsored a formal public meeting in accordance with CERCLA Section 117(a)(2) on March 11, 1993 to discuss the FS and PP. The Responsiveness Summary is provided in the attached Appendix.

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4.0 SCOPE AND ROLE OF THE OPERABLE UNIT

This ROD addresses the first of several planned OUs for the Site.

- The CBA OU addresses VOC-impacted groundwater (on- and offbase) and the TCE soil sources in the CBA (including chromium commingled with TCE at IRP site 9).
- The remaining OUs will address soil contamination and contamination in groundwater. (Excluding the VOC- impacted groundwater of the CBA).

The CBA OU is defined as groundwater containing VOCs above maximum contaminant levels (MCLs), and four TCE source areas: the MW90 Area, Building 658, IRP site 9, and Building 763. Chromium is commingled with TCE at IRP site 9 so it will also be addressed as part of the CBA OU.

The principal human threat from VOCs in groundwater is through ingestion of extracted groundwater and inhalation of airborne vapors while showering. The principal human threat from chromium in soil is through ingestion and dermal contact. There is no current threat to human health from TCE or its byproducts/degradation products as long as there are no activities (i.e., excavation) which disturbs the soil. TCE in soils poses a potential future threat to public health and a threat to the environment. There is a threat due to TCE in soil to the environment from further contaminant migration and groundwater degradation. The purpose of this OU is to both address soil sources that have or continue to impact groundwater and soil sources that pose a risk to public health via direct contact (e.g., soils with elevated chromium), to prevent any further migration of the contaminants in groundwater, to prevent any future exposure to the public of contaminated groundwater, and to restore all on- and offbase groundwater impacted by the CBA to drinking water quality.

GROUNDWATER CONTAMINATION

Seven chemicals have been identified as contaminants of concern in groundwater¹. The highest concentrations of contaminants detected (December 1991/July 1992) are: benzene (12 µg/L), 1,2-dichloroethane (1.9 µg/L), 1,2-dichloroethylene (120 µg/L), tetrachloroethylene (2 µg/L), 1,1,1-trichloroethane (0.9 µg/L), TCE (550 µg/L), and vinyl chloride (1 µg/L).

A treatability study began in 1992 when Norton AFB installed a groundwater pump and treat system in the most contaminated portion of the VOC groundwater plume. This treatability study is being conducted to evaluate the effectiveness of this technology on specific site conditions. The pump and treat system will continue to operate until the CBA OU groundwater remedy is implemented.

SOIL CONTAMINATION

Two chemicals have been identified as primary contaminants of concern in soils. The highest concentrations of contaminants detected are: TCE (69 mg/kg) and chromium (7,570 mg/kg). Chromium is present at IRP site 9 only.

¹ Refer to Section 1.2.2 of the Final CBA OU FS for a discussion of dense non-aqueous phase liquids.

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5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 SOURCES OF CONTAMINATION

Phase I/II Investigation

Elevated levels of TCE were detected in groundwater samples collected from monitoring wells within the CBA. TCE was detected at 4,630 $\mu\text{g/L}$ in MW90 in September 1988. TCE sources were not identified.

CBA OU Remedial Investigation

The CBA Groundwater Investigation defined the VOC plume onbase and confirmed that the plume was migrating offbase. The TCE Source Investigation identified four TCE source areas: the MW90 Area, Building 658, IRP site 9, and Building 763. The work to define downgradient extent is ongoing but will not affect the selected remedy, as the CBA remedial action described in this ROD will address the entire offbase contaminant plume.

5.2 CONTAMINATION AND AFFECTED MEDIA

5.2.1 GROUNDWATER

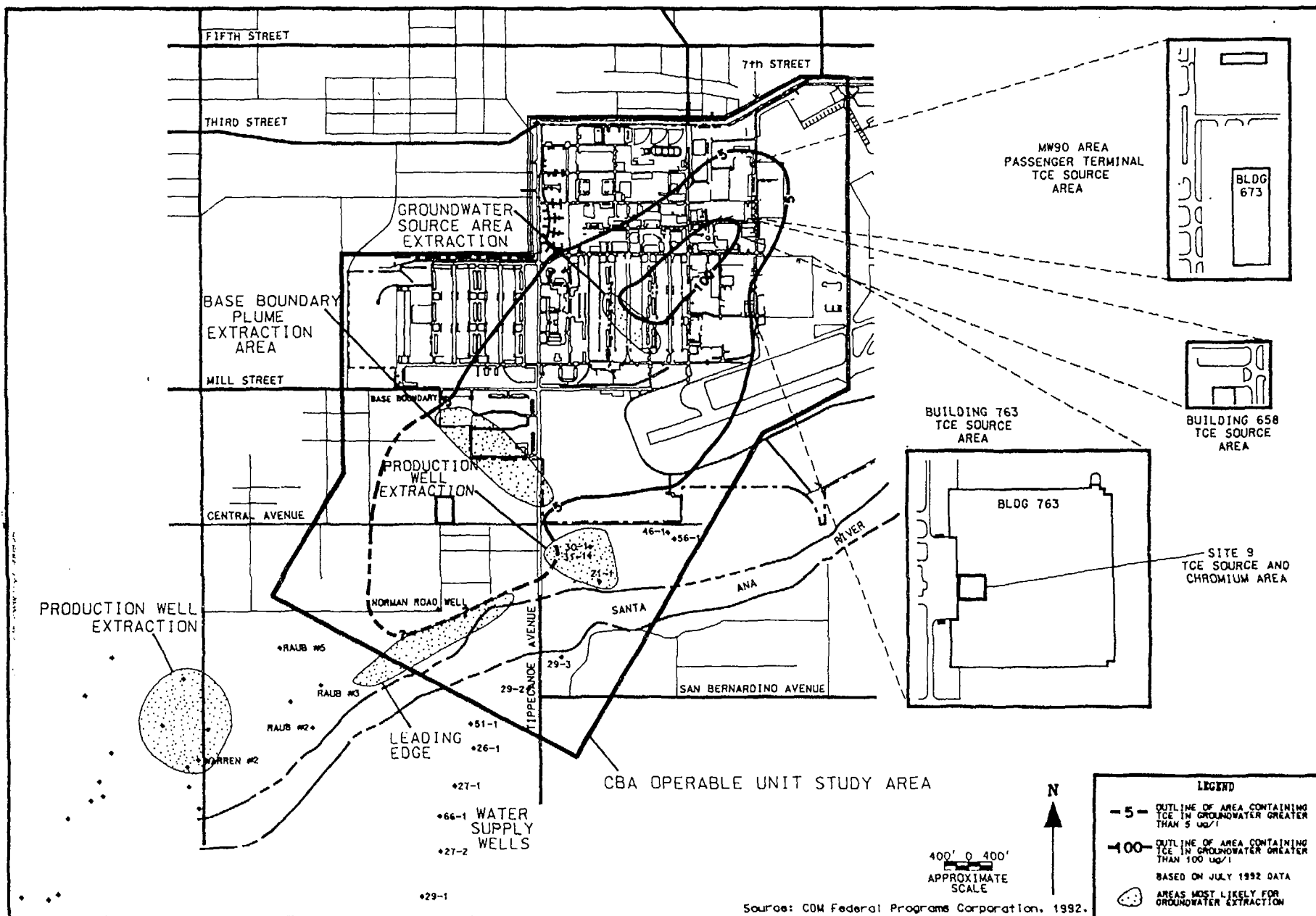
Groundwater containing VOCs was detected along 7th Street, extending beyond the southwestern base boundary. TCE is the most widespread of the contaminants; all other chemicals of concern are commingled within the TCE plume and can be addressed through a TCE remedy. Groundwater samples upgradient of 7th Street do not contain detectable VOCs. The known extent of TCE in the CBA OU, above its MCL, is shown on Figs. 5-1 through 5-3. Maximum concentrations are provided in Sect. 4.0. TCE has been detected in production wells southwest of the base.

- Gage Canal Complex. City of Riverside analytical data for 13 wells indicate that concentrations of TCE near the detection limit have been sporadically detected in some of the wells between 1988 and 1993.
- Warren-Raub Complexes. City of Riverside analytical data for 16 wells, sampled quarterly between 1989 and 1992, indicate consistent detections of TCE in the Norman Road well, Raub No. 5, and Warren No. 2. The Norman Road well has since been deactivated by the South San Bernardino County Water District because it is a low-producing well. Raub No. 2 and 3, located between the Norman Road well and Warren No. 2, have not contained detectable TCE.

The known volume of groundwater containing VOCs above the MCL (defined by the MCL for TCE of 5 $\mu\text{g/L}$) is approximately 7 billion gallons. The volume will be adjusted after the offbase work has been completed.

The routes of human exposure are ingestion and inhalation of airborne vapors due to extracted groundwater. Only benzene and vinyl chloride are known human carcinogens.

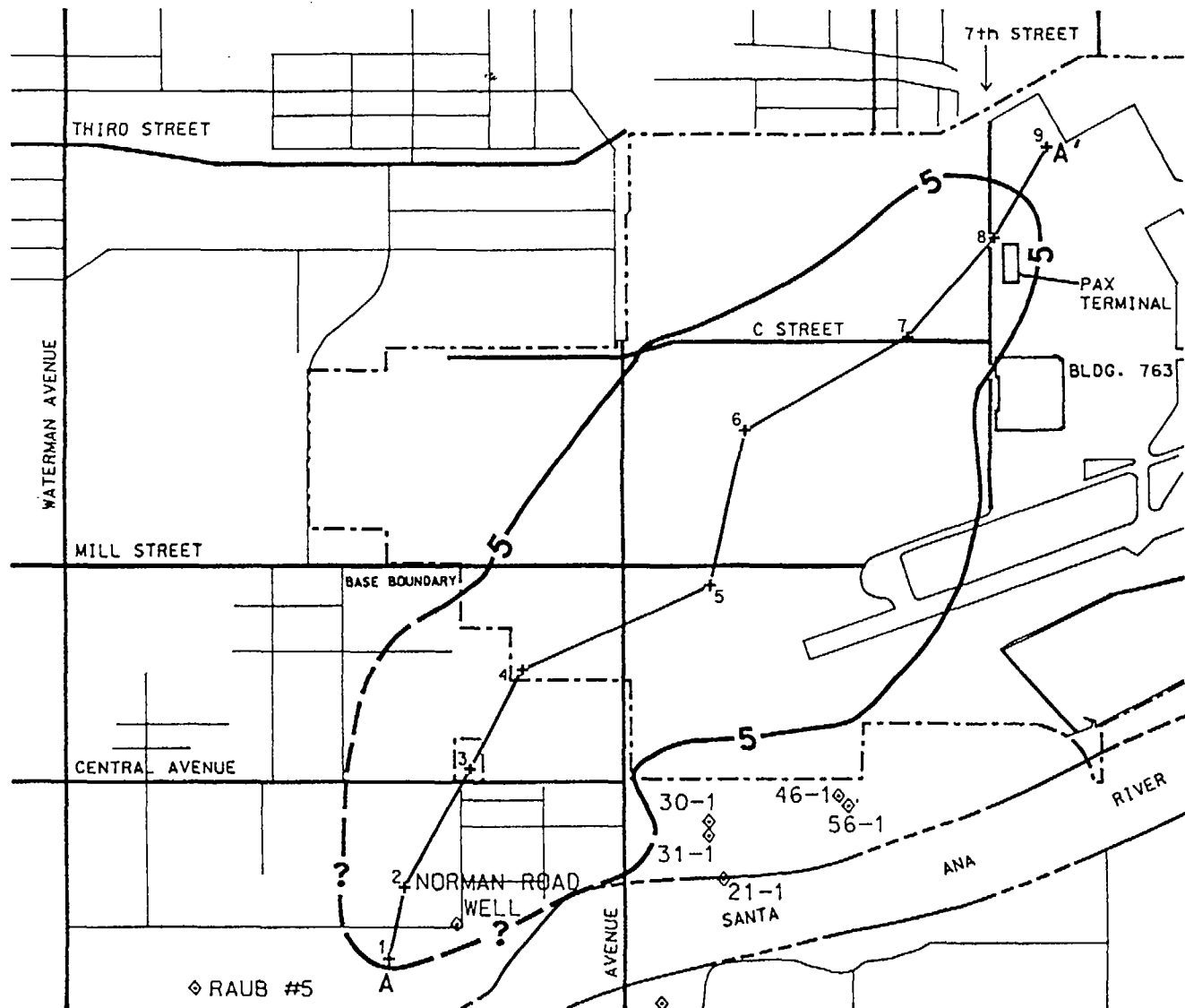
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5-2



NORTON AIR FORCE BASE

APPROXIMATE EXTENT OF TCE IN GROUNDWATER
CBA OPERABLE UNIT

Figure
5-1



Source: CDM Federal Programs Corporation, 1992.

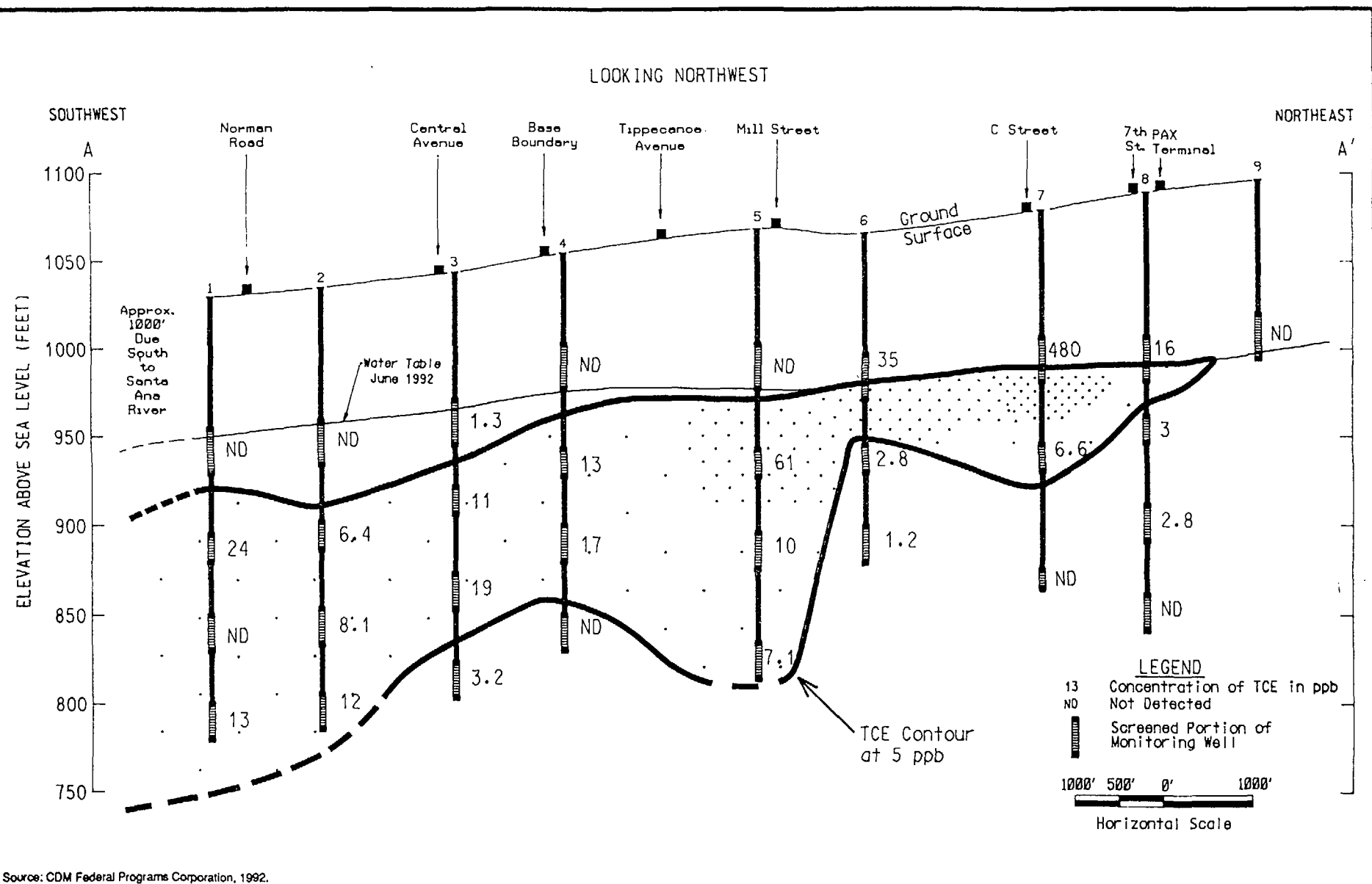
NORTON AIR FORCE BASE

CBA TCE Plume and Line of Section Along Plume Axis
for Use With Figure 5-3 (July 1992 Data)
CBA Operable Unit

Figure No. 5-2

21

5-4



NORTON AIR FORCE BASE

CDM FEDERAL PROGRAMS CORPORATION

a subsidiary of Dresser Industries, Inc.

Cross Section Along Axis of TCE Plume
From MW90 Source Area to Known Offbase Limit (July 1992)

Fig. No. 5-3

5.2.2 SOIL

Four suspected TCE source areas were identified along 7th Street where the majority of current and former industrial and aviation support facilities are located (Fig. 5-1). The water table is located at about 90 to 100 ft below ground surface (bgs).

There is no excess carcinogenic or non-carcinogenic risk associated with TCE in soil. TCE in soil does not pose an adverse health risk due to the low concentrations reported at the four source areas. Chromium in soil at IRP site 9 poses a potential excess carcinogenic risk due to ingestion and dermal contact. Based on the California Potency Factor of $510 \text{ (mg/kg-day)}^{-1}$ for chromium, a 150 mg/kg concentration was determined to pose adverse risk. TCE and chromium are mobile in soil. Maximum concentrations are provided in Sect. 4.0.

DEEP SUBSURFACE SOILS

Deep subsurface soil is defined as affected soil deeper than 20 ft bgs that cannot be readily excavated using conventional construction/excavation equipment or methods. The total volume of deep subsurface soil affected is 148,700 cy.

- MW90 Area. TCE has been detected at depths from 20 to 75 ft bgs. Approximately 125,000 cy of soil contain detectable levels of TCE. Soil containing TCE is not continuous and distribution appears to be confined to finer-grained strata.
- Building 763. TCE has been detected at depths from 20 to 60 ft bgs. Approximately 23,700 cy of soil contain detectable levels of TCE. Deep subsurface soil containing TCE is not continuous below the building and distribution appears to be confined to finer-grained strata. Localized areas have probably affected groundwater quality in the past.

SHALLOW SUBSURFACE SOILS

Shallow subsurface soil is defined as affected soil less than 20 ft bgs that can be readily excavated using conventional construction/excavation equipment or methods.

TCE Only. TCE has been detected at Building 658 and Building 763. The total volume of shallow subsurface soil affected with TCE only is 5,650 cy.

- Building 658. TCE has been detected at depths from 2.5 to 10 ft bgs. Approximately 490 cy of soil contain detectable levels of TCE.
- Building 763. TCE has been detected at depths from 5 to 15 ft bgs. Approximately 5,160 cy of soil contain detectable levels of TCE in five separate shop areas. These areas may have affected or could affect groundwater quality.

The upper 3 ft of soil in Docks 3 and 4 of Building 763 was excavated in 1991 by Lockheed as a structural engineering action to install a new floor capable of supporting Boeing 747 aircraft. Excavated soil contained TCE. The maximum TCE concentration was 1.1 mg/kg; the average TCE concentration was less than 0.05 mg/kg. The excavation was deemed a removal action and performed under an Air Force Action Memorandum. Excavated soil was treated onsite using an active soil vapor extraction system. Samples collected after treatment showed no detectable TCE using Toxicity Characteristics Leaching Procedure (TCLP) tests.

TCE and Chromium. TCE and chromium have been detected from 0 to 7 ft bgs at IRP site 9. Approximately 415 cy of soil contain detectable levels of chromium commingled with TCE.

6.0 SUMMARY OF RISK ASSESSMENT

Using data collected during the CBA OU RI¹, the baseline risk assessment was prepared to evaluate the potential human health risks associated with the CBA OU in the absence of any remedial (corrective) action. The no-action alternative is evaluated in accordance with § 300.430(d) of the NCP.

6.1 HEALTH RISKS

Chemicals of concern were selected based on frequency of detection, toxicity, concentration in media, and comparison of levels found at the site to background concentrations. These contaminants in groundwater and/or soils, their frequency of detection, and their maximum and mean concentrations are listed in Table 6-1.

TABLE 6-1

CHEMICALS OF CONCERN^a IN GROUNDWATER^b AND SOILS, MAXIMUM CONCENTRATIONS, AND FREQUENCY OF DETECTION BASED ON DATA USED IN THE CBA OU BASELINE RISK ASSESSMENT

Media	Chemical	Frequency of Detection	Maximum Concentration	Mean* Concentration
Groundwater (µg/L)	benzene	0/164 ^c	ND	0.28
	1,2-dichloroethane	10/164	3.2	0.27
	1,2-dichloroethylene (total)	61/164	120	5.3
	tetrachloroethylene	28/164	3.9	0.42
	1,1,1-trichloroethane	12/164	3.5	0.36
	TCE	95/164	550	29
	vinyl chloride	0/164 ^c	ND	0.13
Soil (mg/kg)	TCE	160/390	69	9.2
	chromium	14/410	7,570	420

a - Chemicals of concern were evaluated in the risk assessment and determined to pose a risk.

b - Groundwater data is based on June and December 1991 sampling rounds only.

c - Benzene and vinyl chloride have been detected once in groundwater samples collected at the site in sampling rounds subsequent to December 1991.

* - This mean concentration represents the mean concentration used in the risk assessment for the most contaminated unit of the industrial grid. When a chemical of potential concern was not detected in a sample, 1/2 the detection limit was used.

ND - Not detected.

¹ All RI data have been validated and the quality is acceptable to support the recommendation of this ROD.

Only two of the eight compounds listed in Table 6-1 (benzene and vinyl chloride) are known human carcinogens. TCE, tetrachloroethylene, and 1,2-dichloroethane have been shown to be carcinogenic in animals and have been classified by USEPA as possible or probable human carcinogens. The noncarcinogenic contaminants have been observed to have toxic potential based on laboratory studies and reported effects on humans under certain exposure situations.

The potential receptors include the following: residential child/adult, residential child, and light industrial worker. The principal exposure pathways by which human receptors could potentially be exposed to site contaminants are ingestion of contaminants in groundwater, inhalation of airborne vapors while showering, ingestion of contaminants in soils, and dermal contact with contaminants in soils. Standard assumptions for evaluating exposures occurring from domestic use of water (i.e., consumption of 2 liters per day, showering, washing, etc.) should be protective of all residents including children. NOTE: U.S. EPA only considers children separately when their exposures are considered to be significantly higher than those for adults (e.g. soil ingestion.)

As recommended in USEPA guidance, a reasonable maximum exposure was estimated for the three receptor groups. In order to estimate the reasonable maximum exposure, the chronic daily intake was estimated for each pathway based on conservative exposure assumptions. The exposure point concentrations of contaminants in groundwater were estimated using sample data collected in June and December 1991. To estimate exposure point concentrations in soils, it was assumed that all asphalt and concrete were removed above the soil. Subsurface soils would be excavated to a 20-ft depth for a residential setting and a 5-ft depth for a light industrial setting.

The carcinogenic and noncarcinogenic risks based on no cleanup are presented in Table 6-2. The calculated risk is an estimate of the increased likelihood of cancer resulting from exposure to carcinogens. The carcinogenic risks for all receptor groups are in USEPA's acceptable range of 10^{-4} to 10^{-6} when using USEPA slope factors. When using Cal-EPA slope factors, however, the residential child/adult and residential child group exceed the acceptable range for soil ingestion and dermal contact with soils. The difference between the estimated risk when using USEPA and Cal-EPA slope factors is primarily due to chromium. Cal-EPA has derived an oral slope factor for chromium, while the USEPA has not derived an oral slope factor for chromium.

For noncarcinogens, a hazard index greater than 1 indicates that adverse health effects could occur. Hazard index numbers are greater than 1 for the residential child and residential child/adult receptor groups. The noncarcinogenic risk is primarily due to soil ingestion and dermal contact with chromium. While the hazard index exceeds one for groundwater ingestion, the risk is primarily due to background minerals concentrations; the risk from groundwater ingestion is primarily due to the background risk.

There are many sources of uncertainty associated with this risk assessment including:

- Drought conditions in California and population growth in the San Bernardino area have resulted in a lowering of the groundwater table. Using the most recent data collected only represents current conditions. Changing conditions may necessitate re-evaluating the risk.
- The toxicity values reported by USEPA are well publicized, documented and supported. Uncertainty exists because Cal-EPA values reported occasionally differ from USEPA values and they have less support nationwide than those reported by USEPA.

TABLE 6-2
SUMMARY OF CARCINOGENIC AND NONCARCINOGENIC RISK

	Cancer Risk Using EPA Slope Factors	Cancer Risk Using Cal-EPA Slope Factors	Hazard Index	Risk Acceptable ²
<u>Residential Child/Adult</u>				
Ingestion of Groundwater	8.6×10^{-6}	6.9×10^{-5}	2.8	No
Inhalation of Vapors	2.0×10^{-6}	1.5×10^{-6}	0.000013	Yes
Ingestion of Soils	7.0×10^{-7}	3.1×10^{-3}	16.4	No
Dermal Contact with Soils	<u>5.7×10^{-6}</u>	<u>6.4×10^{-4}</u>	<u>2.9</u>	<u>No</u>
Subtotal:	1.7×10^{-5}	3.8×10^{-3}	22.1	No
<u>Residential Child</u>				
Ingestion of Groundwater	3.2×10^{-6}	2.6×10^{-5}	1.8	No
Ingestion of Soils	4.9×10^{-7}	2.2×10^{-3}	5.7	No
Dermal Contact with Soils	<u>2.9×10^{-6}</u>	<u>5.3×10^{-4}</u>	<u>1.1</u>	<u>No</u>
Subtotal:	6.6×10^{-6}	2.8×10^{-3}	8.6	No
<u>Light Industrial Worker</u>				
Ingestion of Groundwater	2.0×10^{-6}	1.6×10^{-5}	0.4	Yes
Ingestion of Soils	1.8×10^{-8}	3.2×10^{-6}	0.06	Yes
Dermal Contact with Soils	<u>1.2×10^{-7}</u>	<u>5.2×10^{-6}</u>	<u>0.009</u>	<u>Yes</u>
Subtotal:	2.1×10^{-6}	5.3×10^{-5}	0.5	Yes

² The risk was deemed acceptable if the cancer risk is in the range of 1×10^{-4} to 1×10^{-6} and the Hazard Index is less than 1.

- The risk may be overestimated due to conservative methods used to select potential soil and groundwater exposure point concentrations; assumptions regarding intake, frequency, and duration of exposure; and estimates of health effects criteria.

6.2 ECOLOGICAL RISKS

There are no streams or ponds within the CBA OU. Controlled storm water drainage at Norton AFB generally consists of surface flow to diversion structures and collection pipes discharging to local surface streams. The Santa Ana River wash is immediately south of the base. There are two jurisdictional wetlands on the western portion of Norton AFB. Neither the river wash nor the wetlands are associated with the CBA OU because there is no groundwater to surface water pathway and no surface water to wetlands pathway.

No threatened or endangered plant species are associated with the CBA OU. The burrowing owl, listed as a State of California Species of Special Concern³, occurs as a year round resident near runways and buildings at Norton AFB; there are no ARARs for Species of Special Concern. The burrowing owl is not present in any buildings associated with the remedy.

The surface areas of Norton AFB associated with the CBA OU are all paved or urbanized/landscaped and there is no discharge of groundwater to the surface at the present time. Therefore, there is no exposure pathway by which a contaminant could move from a surface source to an ecological receptor in the environment. In addition, it is not likely that an exposure point to ecological receptors from groundwater would exist in the future due to existing groundwater levels and the current trend toward decreasing groundwater elevations.

6.3 CONCLUSIONS

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment. A summary of the risks is presented in Table 6-2. Using the USEPA slope factors, the carcinogenic risk is 1.7×10^{-6} for the residential child/adult, 6.6×10^{-6} for the residential child, and 2.1×10^{-6} for the light industrial worker. Using Cal-EPA slope factors, the carcinogenic risk is 3.8×10^{-3} for the residential child/adult, 2.8×10^{-3} for the residential child, and 5.3×10^{-5} for the light industrial worker. The noncarcinogenic risk exceeds unity for the residential child/adult and the child.

The risk to ecological receptors appears to be low. There is no available pathway from the CBA OU contaminants to ecological receptors.

³ Species of Concern are not protected under the Endangered Species Act.

7.0 DESCRIPTION OF ALTERNATIVES

The remedial alternatives for groundwater and soil that have been carried through a detailed analysis in the Final CBA OU FS are presented. Technical information supporting each alternative and the future risk associated with implementation of a remedial action is presented in the FS.

7.1 REMEDIAL ALTERNATIVES FOR GROUNDWATER

Approximately 7 billion gallons of groundwater in the Class I upper aquifer located beneath and extending beyond Norton AFB is estimated to contain VOCs above their MCLs. The cumulative carcinogenic risk to human health from groundwater is 1.1×10^{-6} (EPA slope factor) and 7.1×10^{-6} (Cal-EPA slope factor) from ingestion, and inhalation of airborne VOCs while showering. There are three groundwater alternatives (Fig. 7-1). The ARARs for each alternative are identified in Table 7-1. The text highlights the major ARARs.

Groundwater at Norton AFB contains TCE and other VOCs, including tetrachloroethylene (PCE) and 1,1,1-trichloroethane (TCA). The situation at Norton AFB is sufficiently similar to other situations for which the RCRA requirements for treatment, storage, and disposal were designed, and therefore the RCRA requirements for treatment, storage, and disposal are applicable for the TCE-containing material. Specifically, the RCRA "contained-in" policy would apply. Groundwater containing TCE, PCE, and TCA must be handled as if it were a hazardous waste until the groundwater no longer contains the listed waste. At Norton AFB, it has been determined that if the groundwater is treated to the cleanup standards of 5 ppb, the groundwater will no longer be considered to contain a listed waste and need not be handled as a hazardous waste.

ALTERNATIVE 1A - NO ACTION

This alternative, required for consideration by the NCP, involves no remedial actions to address groundwater contamination. No action is implemented. This alternative will not comply with relevant and appropriate federal and state MCLs established in the National Primary Drinking Water Standards [40 CFR §141.61(a)] and Drinking Water Primary Standards [Title 22 CCR Division 4 §64444.5], respectively. This alternative will not reduce the risk to human health posed by the VOCs in groundwater.

ALTERNATIVE 1B - AIR STRIPPING

- Deed restrictions
- Groundwater monitoring
- Groundwater extraction
- Wellhead treatment or provision of water supplies
- Treatment by air stripping
- Direct discharge of emissions to atmosphere, or treatment by vapor-phase carbon adsorption if emissions are not in compliance with air quality ARARs
- Reinjection of treated water

The volume of groundwater to be treated is based on current site knowledge of the plume extent. Further characterization of the off-base portion of the TCE-contaminated plume which originates in the CBA is being performed. The results of the characterization will affect design of this alternative both on- and offbase, but not selection of the remedy. Prior to sale or transfer of any Norton AFB property overlying the contaminated groundwater plume, the AF will record a land use restriction in accordance with California Health and Safety Code §25230 as an institutional control to prohibit installation of additional wells until after the groundwater standards have been achieved, and the

**ALTERNATIVE 1A
NO ACTION**

2.4 x 10⁻⁶ carcinogenic risk level remains.

**ALTERNATIVE 1B
AIR STRIPPING**

Total Cost \$28.0M
(excluding emission controls)

Deed Restrictions	Groundwater Monitoring	Groundwater Extraction	Wellhead Treatment/ Providing Water	Air Stripping	Discharge of Treated Groundwater
<ul style="list-style-type: none"> Deed restrictions imposed on Norton AFB property until cleanup standards are attained. 	<ul style="list-style-type: none"> Quarterly groundwater monitoring to monitor plume and determine effectiveness of alternative. 	<ul style="list-style-type: none"> 7 Billion Gal. Groundwater Contaminated With VOCs; 2.4 x 10⁻⁶ carcinogenic risk level Maximum Concentration¹ TCE: 500 ug/L Benzene: 12 ug/L 1,2-dichloroethane: 1.9 ug/L 1,2-dichloroethylene: 120 ug/L Tetrachloroethylene: 2 ug/L 1,1,1-Trichloroethane: 0.9 ug/L Vinyl Chloride: 1 ug/L 	<ul style="list-style-type: none"> Wellhead treatment with mobile GAC treatment unit or providing water supplies in accordance with off-base water contingency policy 	<ul style="list-style-type: none"> Direct discharge at 1.6 x 10⁻⁷ carcinogenic risk level Vapor-phase carbon adsorption built in; use contingent upon emissions levels Treatment for 30 years to meet cleanup standards 	<ul style="list-style-type: none"> Groundwater treated to cleanup standards Reinjection of treated water Residual Risk no greater than 10⁻⁶

**ALTERNATIVE 1C
CARBON ADSORPTION**

Total Cost \$133M

Deed Restrictions	Groundwater Monitoring	Groundwater Extraction	Wellhead Treatment/ Providing Water	Liquid-Phase Carbon Adsorption	Discharge of Treated Groundwater
<ul style="list-style-type: none"> Deed restrictions imposed on Norton AFB property until cleanup standards are attained. 	<ul style="list-style-type: none"> Quarterly groundwater monitoring to monitor plume and determine effectiveness of alternative. 	<ul style="list-style-type: none"> 7 Billion Gal. Groundwater Contaminated With VOCs; 2.4 x 10⁻⁶ carcinogenic risk level Maximum Concentration¹ TCE: 500 ug/L Benzene: 12 ug/L 1,2-dichloroethane: 1.9 ug/L 1,2-dichloroethylene: 120 ug/L Tetrachloroethylene: 2 ug/L 1,1,1-Trichloroethane: 0.9 ug/L Vinyl Chloride: 1 ug/L 	<ul style="list-style-type: none"> Wellhead treatment with mobile GAC treatment unit or providing water supplies in accordance with off-base water contingency policy 	<ul style="list-style-type: none"> Spent carbon handled in accordance with RCRA Subtitle C ARARs if tested as hazardous waste Regeneration at off-site regeneration facility Treatment for 30 years to meet cleanup standards 	<ul style="list-style-type: none"> Groundwater treated to cleanup standards Reinjection of treated water Residual Risk no greater than 10⁻⁶

M = million dollars

1 = Based on sampling conducted after December 1991

NORTON AIR FORCE BASE

Groundwater Alternatives

TABLE 7-1

COMPARATIVE ANALYSIS OF COMPLIANCE WITH ARARS
GROUNDWATER TREATMENT ALTERNATIVES

ARAR		Alternative 1B ¹ Air Stripping	Alternative 1C ¹ Carbon Adsorption
<u>Chemical-Specific</u>	Maximum Contaminant Levels (MCLs)	Air stripping can remove groundwater contaminants to meet MCLs: TCE (5 µg/L); benzene (1 µg/L); 1,2-DCA (0.5 µg/L); Total 1,2-DCE (6 µg/L); PCE (5 µg/L); 1,1,1,-TCA (200 µg/L); and vinyl chloride (0.5 µg/L). MCLs are relevant and appropriate for groundwater that is a potential drinking water source.	Activated carbon can remove groundwater contaminants to meet MCLs: TCE (5 µg/L); benzene (1 µg/L); 1,2-DCA (0.5 µg/L); Total 1,2-DCE (6 µg/L); PCE (5 µg/L); 1,1,1,-TCA (200 µg/L); and vinyl chloride (0.5 µg/L). MCLs are relevant and appropriate for groundwater that is a potential drinking water source.
	Low-Level Radioactive Waste Policy Amendment Act (42 USC §52021(b) - 2021(j))	If activated carbon is required, it will be tested frequently for radioactivity level to ensure compliance with this relative and appropriate Act. This requirement is relevant and appropriate; it is not applicable because spent carbon would not meet the definition of a low-level radioactive waste. The definition applies to source materials, not naturally occurring radiation.	Activated carbon will be tested frequently for radioactivity level to ensure compliance with this relevant and appropriate Act. This requirement is relative and appropriate; it is not applicable because spent carbon would not meet the definition of a low-level radioactive waste. The definition applies to source materials, not naturally occurring radiation.
	National Emission Standards for Hazardous Air Pollutants - NESHAPs (40 CFR §61.63, §61.92, §61.102, and §61.348)	Air stripping will comply with this relevant and appropriate ARAR. Due to low radionuclide concentrations in groundwater, radionuclide emissions will not result in any member of the public receiving an effective dose of 10 millirems/year due to exposure to emissions. Due to low concentrations of vinyl chloride in groundwater, vinyl chloride emissions will not exceed 10 ppm (3 hour average). Due to low concentrations of benzene, air stripping emissions will not contain more than 10 megagrams benzene per year. NESHAPs are not applicable because groundwater is not "at least 10% volatile hazardous air pollutants by weight". However, the substantive requirements will be complied with.	NA; no emissions.
<u>Location-Specific</u>	RCRA Location Standards (Title 22 CCR Chapter 14 §66264.18)	Facility will not be constructed within 200 ft of an earthquake fault and, if sited within the 100-year floodplain, will be designed, constructed, operated and maintained to prevent washout of waste. This ARAR is relevant and appropriate.	Facility will not be constructed within 200 ft of an earthquake fault and, if sited within the 100-year floodplain, will be designed, constructed, operated and maintained to prevent washout of waste. This ARAR is relevant and appropriate.

1 Alternatives 1B and 1C include wellhead treatment by mobile GAC units for affected off-base wells, as outlined in the Norton AFB Water Supply Contingency Policy. Therefore, ARARs pertaining to carbon adsorption (Alternative 1C) are also ARARs for mobile GAC units under Alternative 1B.
NA - Not an ARAR

TABLE 7-1 (continued)
COMPARATIVE ANALYSIS OF COMPLIANCE WITH ARARS
GROUNDWATER TREATMENT ALTERNATIVES

ARAR	Alternative 1B ¹ Air Stripping	Alternative 1C ¹ Carbon Adsorption
<u>Action-Specific</u>		
Tank Systems (Title 22 CCR §66264.190-66264.199)	Relevant and appropriate substantive requirements will be incorporated into design and operation of the tanks used to store groundwater.	Relevant and appropriate substantive requirements will be incorporated into design and operation of carbon treatment units and associated tanks used to store groundwater.
Miscellaneous Units (Title 22 CCR §66264.600-66264.603)	The air stripping tower will be located, designed, constructed, operated, maintained, and closed in a manner that ensures protection of human health and the environment (e.g., prevention of releases) and will thereby comply with the relevant and appropriate substantive requirements for miscellaneous treatment units.	NA; carbon units and associated tanks are regulated under RCRA tank regulations.
Generator Standards (Title 22 CCR §66262.34)	Will comply with applicable generator standards for accumulation and storage of spent carbon.	Will comply with applicable generator standards for accumulation and storage of spent carbon.
Standards for Protection Against Radiation (10 CFR Part 20)	NA; no radioactive waste is generated.	Spent carbon will not exceed permissible levels of radiation in unrestricted areas (due to absorption of naturally occurring radionuclides), including: whole body dose of 0.5 rem/year, 0.002 rem/hour, or 0.1 rem in 7 consecutive days. This ARAR is relevant and appropriate; it is not applicable because spent carbon is not a Nuclear Regulatory Commission-licensed waste.
Underground Injection Control (40 CFR §144)	The groundwater reinjection wells are regulated under the UIC program. Reinjection of treated water using reinjection wells will comply with the applicable substantive requirements of the UIC permit program, including general program requirements, for Class V wells.	The groundwater reinjection wells are regulated under the UIC program. Reinjection of treated water using reinjection wells will comply with the applicable substantive requirements of the UIC permit program, including general program requirements, for Class V wells.
Transportable Treatment Unit (Title 22 CCR §67450)	The air stripping tower is considered a fixed treatment unit. Operation of the air stripping tower will comply with applicable substantive requirements for fixed treatment units, including discharge of treated effluent and treatment at site of waste generation.	A carbon treatment system is considered a fixed treatment unit; the mobile carbon units for wellhead treatment are considered transportable treatment units. Operation of the carbon units will comply with applicable substantive requirements for fixed and transportable treatment units, including discharge of treated effluent and treatment at site of waste generation.

¹ Alternatives 1B and 1C include wellhead treatment by mobile GAC units for affected off-base wells, as outlined in the Norton AFB Water Supply Contingency Policy. Therefore, ARARs pertaining to carbon adsorption (Alternative 1C) are also ARARs for mobile GAC units under Alternative 1B.

NA - Not an ARAR

TABLE 7-1 (continued)

COMPARATIVE ANALYSIS OF COMPLIANCE WITH ARARS
GROUNDWATER TREATMENT ALTERNATIVES

ARAR	Alternative 1B ¹ Air Stripping	Alternative 1C ¹ Carbon Adsorption
SCAQMD Rules		
• Rule 401 - Visible Emissions	Air stripping will comply with applicable Rule 401 because it will not produce visible emissions of any air contaminant for a period(s) aggregating more than three minutes in an hour which is: (a) as dark or darker than the designated No. 1 on the Ringelmann Chart, or (b) of such opacity as to obscure an observer's view to a degree equal to or greater than does smoke as described in (a) above.	NA; no emissions.
• Rule 403 - Fugitive Dust	Applicable to particulate matter due to construction/excavation. Installation of groundwater wells will comply with fugitive dust regulations; particulate matter will not exceed 50 $\mu\text{g}/\text{m}^3$.	Applicable to particulate matter due to construction/excavation. Installation of groundwater wells will comply with fugitive dust regulations; particulate matter will not exceed 50 $\mu\text{g}/\text{m}^3$.
• Rule 404 - Particulate Matter	Air stripping will comply with applicable Rule 404 due to low particulate matter emissions expected (the concentrations of contaminants that would be considered particulate matter, e.g., radionuclides, are low). Air stripping will not discharge particulate matter in excess of the discharge particulate matter standard that corresponds to the volume of emissions discharged (determined as dry gas) or in excess of 450 milligrams per cubic meter in emissions (as dry gas). The volume of emissions will be determined during design.	NA; no emissions.

1 Alternatives 1B and 1C include wellhead treatment by mobile GAC units for affected off-base wells, as outlined in the Norton AFB Water Supply Contingency Policy. Therefore, ARARs pertaining to carbon adsorption (Alternative 1C) are also ARARs for mobile GAC units under Alternative 1B.

NA - Not an ARAR

TABLE 7-1 (continued)

COMPARATIVE ANALYSIS OF COMPLIANCE WITH ARARS
GROUNDWATER TREATMENT ALTERNATIVES

ARAR	Alternative 1B ¹ Air Stripping	Alternative 1C ¹ Carbon Adsorption
• Rule 408 - Circumvention	The air stripping alternative will not include equipment that would, without a reduction in the total release of air contaminants to the atmosphere, reduce or conceal an emission that would otherwise violate SCAQMD rules or Chapter 3, Part 4, Division 26 of the Health and Safety Code; air stripping will comply with this applicable rule.	NA; no emissions.
• Regulation XIII - New Source Review, Rule 1303	Rule 1303 (a) is applicable to net increases in emissions of 1,1,1 TCA (regulated halogenated hydrocarbon) and ozone. Due to the low groundwater VOC concentrations, emissions will be below the 1 lb/day limit above which Best Available Control Technology (BACT) is required to limit emission increases (SCAQMD considers an emissions increase to be an increase of at least 1 lb/day, current expected emissions are 0.078 lb/day). However, the air stripping tower will be equipped with a vapor-phase carbon adsorption unit for treatment of emissions which will be used if direct discharge does not comply with air quality ARARs (carbon adsorption is BACT for air stripping emissions). The AF will consult with the SCAQMD regarding emissions offsets required in Rule 1303 (b) during design.	NA; no emissions.
• Rule 1401 - New Source Review of Carcinogenic Air Contaminants	Applicable to emissions of TCE and vinyl chloride (regulated carcinogenic air contaminants) from new sources (air stripper). Air stripping emissions of TCE and vinyl chloride will comply because emissions will be below the 1×10^{-6} risk level stated in the Rule. Substantive requirements pertaining to permits will be met.	NA; no emissions.

1 Alternatives 1B and 1C include wellhead treatment by mobile GAC units for affected off-base wells, as outlined in the Norton AFB Water Supply Contingency Policy. Therefore, ARARs pertaining to carbon adsorption (Alternative 1C) are also ARARs for mobile GAC units under Alternative 1B.

NA - Not an ARAR

TABLE 7-1 (continued)

COMPARATIVE ANALYSIS OF COMPLIANCE WITH ARARS
GROUNDWATER TREATMENT ALTERNATIVES

ARAR	Alternative 1B ¹ Air Stripping	Alternative 1C ¹ Carbon Adsorption
Water Quality Objectives (Water Quality Control Plan, Santa Ana River Basin Plan)	Water quality objectives are applicable to discharges affecting waters of the state. The Air Force is responsible for water quality objectives pertaining to its contaminants.	Water quality objectives are applicable to discharges affecting waters of the state. The Air Force is responsible for water quality objectives pertaining to its contaminants.
State Resolution 68-16	Reinjection of groundwater treated by Best Demonstrated Control Technology to concentrations no greater than MCLs will comply with applicable State Resolution 68-16; treated groundwater will be reinjected into the plume where concentrations are greater than that of treated water. If groundwater is reinjected outside the plume where concentrations are less than that of treated water, the groundwater will not exceed 5 µg/L at any time or 0.5 µg/L averaged over a 30-day period for each of the groundwater contaminants listed in Table 9-1.	Reinjection of groundwater treated by Best Demonstrated Control Technology to concentrations no greater than MCLs will comply with applicable State Resolution 68-16; treated groundwater will be reinjected into the plume where concentrations are greater than that of treated water. If groundwater is reinjected outside the plume where concentrations are less than that of treated water, the groundwater will not exceed 5 µg/L at any time or 0.5 µg/L averaged over a 30-day period for each of the groundwater contaminants listed in Table 9-1.

1 Alternatives 1B and 1C include wellhead treatment by mobile GAC units for affected off-base wells, as outlined in the Norton AFB Water Supply Contingency Policy. Therefore, ARARs pertaining to carbon adsorption (Alternative 1C) are also ARARs for mobile GAC units under Alternative 1B.

NA - Not an ARAR

AF will provide notice of this restriction in any purchase, lease, or other agreement relating to that property. The AF will continue to perform quarterly monitoring of selected groundwater wells that define the limits of the plume and provide information on the effectiveness of the extraction and treatment. Groundwater extraction locations, flowrates, and tower specifications will be determined in the Remedial Design (RD) phase through engineering design and analysis. Groundwater wells will be installed in accordance with the To Be Considered (TBC) Water Well Standards, Bulletin 74-90. The air stripping tower will be designed to remove VOCs in groundwater to levels no greater than the cleanup standards (USEPA and Cal-EPA MCLs).

For off-base water supply wells where contaminant levels exceed MCLs, the AF will provide temporary water treatment facilities using mobile granular activated carbon (GAC) treatment units or alternate water supplies. As appropriate the Air Force will also provide long-term treatment such as permanent installation of an air stripping treatment system, replacement water well, or other actions. These actions will be implemented in accordance with the decision matrix outlined in the Water Supply Contingency Policy, dated August 25, 1993. ARARs identified for carbon adsorption (Alternative 1C) will be ARARs for this portion of Alternative 1B, and will be complied with.

Emissions will be directly discharged, however vapor-phase carbon emission controls will be built into the system; use will be contingent upon emission levels. Direct discharge of air stripping tower emissions into the atmosphere will comply with South Coast Air Quality Management District (SCAQMD) regulations for risk due to emissions and chemical-specific air emissions, and the TBC Statement of Policy on Control of Air Stripper Emissions (OSWER Dir. 9355.028) which provides hourly, daily, and yearly facility-wide emission levels. The cumulative carcinogenic risk to human health predicted from inhalation of VOCs due to direct discharge of air stripper emissions is 1.6×10^{-7} , which is below the 1×10^{-6} risk level in SCAQMD Rule 1401. During the design of the remedy, the AF will coordinate with SCAQMD to ensure that any direct discharge is in compliance with SCAQMD Rule 1303 (applicable to 1,1,1-trichloroethane emissions and ozone produced by VOC emissions) limit of 1 lb/day cumulative emissions of all air strippers. The Air Force will measure emission levels during the design phase to ensure compliance with SCAQMD Rule 1303. If at any point during the air stripping treatment emissions are not in compliance with SCAQMD regulations, the built-in carbon adsorption emission treatment unit will be employed.

- Carbon Adsorption. Specifications will be determined in the RD phase through engineering design and analysis. The system will be designed to remove TCE in vapor such that emissions meet air quality ARARs. Spent GAC generated will be transported offsite by the carbon vendor, who will decide whether carbon will be regenerated or disposed.¹ Before being transported offsite, spent carbon will be tested to determine whether it is a RCRA hazardous waste as defined in Title 22 CCR Division 4.5 §66261. If spent carbon is determined to be a hazardous waste, RCRA regulations for generators of hazardous waste (Title 22 CCR Division 4.5 §66262.34) are applicable. Regulations for off-site transportation will be met. Any risk to human health and the environment is reduced. The total cost for vapor-phase carbon adsorption is \$9,510,000 (based on 30 years of operation).

Treated water will be reinjected in compliance with State Resolution 68-16 and the Santa Ana River Basin Water Quality Control Plan's Water Quality Objectives, or if the technical or economic feasibility prohibits compliance, then the treated water will be reinjected into the same water bearing zone from which water is extracted.

¹ Due to the type of groundwater VOCs, it is expected that carbon will be regenerated.

At the completion of the remedy, the cumulative carcinogenic risk to human health due to 9 ingestion of and inhalation of airborne VOCs in groundwater will be no greater than 10^{-6} . The estimated time to implement this remedy and to meet cleanup standards is 30 years. The total cost of treatment by air stripping for the 30-year period is \$28,050,000 (excluding emission controls).

ALTERNATIVE 1C - CARBON ADSORPTION

- Deed restrictions
- Groundwater monitoring
- Groundwater extraction
- Wellhead treatment or provision of water supplies
- Treatment by liquid-phase GAC adsorption
- ReInjection of treated water

The volume of groundwater to be treated is based on current site knowledge of plume extent. Further plume characterization is being performed. The results of the characterization will affect design of this alternative both on and offsite, but not selection of the remedy. Prior to sale or transfer of any Norton AFB property overlying the contaminated groundwater plume, the AF will record a land use restriction in accordance with California Health and Safety Code § 25230 as an institutional control to prohibit installation of additional wells until after the groundwater standards have been achieved, and the AF will provide notice of this restriction in any purchase, lease, or other agreement relating to that property. The AF will continue to perform quarterly monitoring of selected groundwater wells that define the limits of the plume and provide information on the effectiveness of the extraction and treatment.

Groundwater extraction locations, flowrates, and GAC unit specifications will be determined in the RD phase through engineering design and analysis. Groundwater wells will be installed in accordance with the TBC Water Well Standards, Bulletin 74-90. The GAC units will be designed to remove VOCs in groundwater to levels no greater than the cleanup standards. The spent carbon will be transported offsite by the carbon vendor. The carbon vendor is responsible for determining whether the carbon will be regenerated or disposed². Spent carbon will be tested to determine whether it is a RCRA hazardous waste as defined in Title 22 CCR Division 4.5 §66261. If spent carbon is determined a hazardous waste, RCRA regulations for generators of hazardous waste (Title 22 CCR Division 4.5 §66262.34) are applicable. Spent GAC will be transported in compliance with regulations pertaining to off-site transportation. Spent GAC will be monitored on a long-term basis for radioactivity due to the adsorption of naturally occurring radon gas in groundwater to ensure that carbon does not exceed permissible standards of radiation in the relevant and appropriate Standards for Protection Against Radiation (10 CFR Part 20) and complies with the Low-Level Radioactive Waste Policy Amendment Act of 1985.

For the off-base water supply wells where contaminant levels exceed MCLs, the AF will provide temporary water treatment facilities at affected water supply wells using mobile GAC treatment units or provide alternate water supplies. As appropriate, the AF will also provide long-term treatment such as permanent installation of an air stripping treatment system, replacement water well, or other action. These actions will be implemented in accordance with the decision matrix outlined in the Water Supply Contingency Policy, dated August 25, 1993. ARARs identified for

² Due to the type of groundwater VOCs, it is expected that carbon will be generated.

carbon adsorption (Alternative 1C) will be ARARs for this portion of Alternative 1B, and will be complied with.

Treated water will be reinjected in compliance with State Resolution 68-16 and the Santa Ana River Basin Water Quality Control Plan's Water Quality Objectives, or if the technical or economic feasibility prohibits compliance, then the treated water will be reinjected into the same water bearing zone from which water is extracted.

At the completion of the remedy, the cumulative carcinogenic risk to human health due to ingestion of and inhalation of airborne VOCs in groundwater will be no greater than 10^{-6} . The estimated time to implement this remedy and to meet cleanup standards is 30 years. The total cost for the 30-year period is \$133,060,000.

7.2 REMEDIAL ALTERNATIVES FOR SOILS

7.2.1 DEEP SUBSURFACE SOILS

Approximately 148,700 cy of deep subsurface soil contain TCE: 125,000 cy at the MW90 Area and 23,700 cy at Building 763. The volume of deep subsurface soil affected was determined through RI data. There is no current risk to human health due to direct contact with soil containing TCE. TCE in soil poses a potential future threat to public health and a threat to the environment. The environmental risk is to groundwater because TCE in deep subsurface soils may potentially affect groundwater quality. There are three deep subsurface soil alternatives (Fig. 7-2). The ARARs for each alternative are identified in Table 7-2. The text highlights the major ARARs.

Soil at Norton AFB contains TCE and other VOCs. The situation at Norton AFB is sufficiently similar to other situations for which the RCRA requirements for treatment, storage, and disposal were designed, and therefore the RCRA requirements for treatment, storage, and disposal are applicable for the TCE-containing material. Specifically, the RCRA "contained-in" policy would apply. Soil containing TCE must be handled as if it were a hazardous waste until the soil no longer contains the listed waste. At Norton AFB, it has been determined that if the soil are treated to the cleanup standards of 5 $\mu\text{g/L}$ (ppb) in leachate, the soil will no longer be considered to contain a listed waste and need not be handled as a hazardous waste.

ALTERNATIVE 2A - NO ACTION

This alternative, required for consideration by the NCP, involves no remedial actions to address deep subsurface soil contamination. No action is implemented. This alternative will not comply with the Water Quality Objective for toxicity stated in the Santa Ana River Basin Water Quality Control Plan due to the possible impacts to groundwater from TCE in soil. This alternative will not reduce the risk to the environment posed by the TCE in deep subsurface soils.

ALTERNATIVE 2B - GROUNDWATER MONITORING/PERCHED ZONE DEWATERING

- Deed restrictions
- Groundwater monitoring
- Perched zone dewatering
- Treatment by selected groundwater remedy

Prior to sale or transfer of any Norton AFB property overlying deep subsurface soil contamination, the AF will record a land use restriction in accordance with California Health and Safety Code §25230 as an institutional control to prohibit excavation until after the deep subsurface soil

**ALTERNATIVE 2A
NO ACTION**

Carcinogenic risk level due to TCE is less than 10^{-6} ; groundwater risk remains

**ALTERNATIVE 2B
GROUNDWATER
MONITORING/
PERCHED ZONE
DEWATERING**

Total Cost \$1.74M

Deed Restrictions	Groundwater Monitoring	Perched Zone Dewatering	Treatment
<ul style="list-style-type: none"> Deed restrictions on Norton AFB property overlying deep soil contamination until cleanup standards are attained 	<ul style="list-style-type: none"> Quarterly groundwater monitoring of perched zone and underlying aquifer to monitor water levels, possible migration of TCE in soil 	<ul style="list-style-type: none"> Perched zone wells dewatered when water reaches preset water levels Treatment for 30 years to meet cleanup standards 148,700 cy of Deep Soil Contaminated With VOCs at MW90 and Building 763 Carcinogenic risk level due to TCE is less than 10^{-6} Residual Risk less than 10^{-6} 	<ul style="list-style-type: none"> Extracted perched zone water treated by selected groundwater remedy

**ALTERNATIVE 2C
IN SITU SVE**

Total Cost \$2.37M
(excluding emission control)

Deed Restrictions	Groundwater Monitoring	In Situ SVE	Off-Gas Treatment
<ul style="list-style-type: none"> Deed restrictions on Norton AFB property overlying deep soil contamination until cleanup standards are attained 	<ul style="list-style-type: none"> Quarterly groundwater monitoring of perched zone and underlying aquifer to monitor water levels, possible migration of TCE in soil, and effectiveness of treatment 	<ul style="list-style-type: none"> Treatment for 18 months to meet cleanup standards 148,700 cy of Deep Soil Contaminated With VOCs at MW90 and Building 763 Carcinogenic risk level due to TCE is less than 10^{-6} Residual Risk less than 10^{-6} 	<ul style="list-style-type: none"> SVE off-gas will comply with air quality ARARs through treatment by vapor-phase carbon adsorption, or no treatment if untreated emissions are in compliance

M = million dollars

NORTON AIR FORCE BASE

Deep Subsurface Soils Alternatives

Figure No. 7-2

TABLE 7-2

COMPARATIVE ANALYSIS OF COMPLIANCE WITH ARARs
SOILS ALTERNATIVES

ARAR	Alternative 2B ¹ Perched Zone Dewatering	Alternative 2C/3D In Situ SVE	Alternative 3B/4B Excavation Off-site Disposal	Alternative 3C Excavation/Ex Situ SVE On-base Use	Alternative 4C Excavation/Ex Situ SVE Off-site Disposal
<u>Chemical-Specific</u> Maximum Contaminant Levels (MCLs)	Perched water extracted under Alternative 2B will be treated under the selected groundwater remedy. Through the groundwater remedy, TCE will be removed to meet the relevant and appropriate 5 µg/L MCL (refer to Table 7-1).	NA	NA	NA	NA
<u>Action-Specific</u> Waste Pile (Title 22 CCR §§66264.250-66264.258)	NA	NA	NA	Relevant and appropriate substantive requirements for waste piles will be met. Requirements will be applicable if soil is considered a RCRA waste due to TCE concentrations.	Relevant and appropriate substantive requirements for waste piles will be met. Requirements will be considered applicable if soil is determined to be a RCRA hazardous waste due to TCE or chromium concentrations.
Tank Systems (Title 22 CCR §§66264.190-66264.199)	Perched water requiring treatment will be added to extracted groundwater treated under the groundwater remedy; refer to Table 7-1 for tank compliance under groundwater alternatives.	NA	NA	NA	NA
Generator Standards (Title 22 CCR Div. 4.5 §66262.34)	NA	Will comply with applicable generator standards for accumulation and storage of spent carbon if carbon used to treat SVE emissions is considered a RCRA characteristic waste.	Will comply with applicable generator standards for accumulation and storage of excavated soil if soil is determined a RCRA characteristic waste.	Will comply with applicable generator standards for accumulation and storage of soil or spent carbon (from emissions treatment) if soil or carbon is considered a RCRA characteristic waste.	Will comply with applicable generator standards for accumulation and storage of soil for off-site disposal or spent carbon from emissions treatment if soil or carbon is considered a RCRA hazardous waste.

1 Perched water extracted under Alternative 2B will be treated and discharged under the selected remedy for groundwater. Refer to Table 7-1 for ARARs pertaining to perched water treatment and discharge.

TABLE 7-2 (continued)

COMPARATIVE ANALYSIS OF COMPLIANCE WITH ARARS
SOILS ALTERNATIVES

ARAR	Alternative 2B Perched Zone Dewatering	Alternative 2C/3D In Situ SVE	Alternative 3B/4B Excavation Off-site Disposal	Alternative 3C Excavation/Ex Situ SVE On-base Use	Alternative 4C Excavation/Ex Situ SVE Off-site Disposal
Transportable Treatment Unit (Title 22 CCR §67450)	NA	The SVE unit is considered a transportable treatment unit. The SVE unit will meet the applicable substantive requirements for transportable treatment units. If operating for more than 1 year, SCAQMD approval for an extension of the 1-year stationing limit will be required.	NA	The SVE unit is considered a transportable treatment unit. The SVE unit will meet the applicable substantive requirements for transportable treatment units, including the 1-year stationing limit.	The SVE unit is considered a transportable treatment unit. The SVE unit will meet the applicable substantive requirements for transportable treatment units, including the 1-year stationing limit.
SCAQMD Rules • Rule 401 - Visible Emissions	NA for dewatering. Perched water requiring treatment will be treated under the selected groundwater remedy; refer to Table 7-1 for groundwater alternatives.	SVE will comply with applicable Rule 401 because it will not produce visible emissions of any air contaminant for a period(s) aggregating more than three minutes in an hour which is: (a) as dark or darker than the designated No. 1 on the Ringelmann Chart, or (b) of such opacity as to obscure an observer's view to a degree equal to or greater than does smoke as described in (a) above.	NA	SVE will comply with applicable Rule 401 because it will not produce visible emissions of any air contaminant for a period(s) aggregating more than three minutes in an hour which is: (a) as dark or darker than the designated No. 1 on the Ringelmann Chart, or (b) of such opacity as to obscure an observer's view to a degree equal to or greater than does smoke as described in (a) above.	SVE will comply with applicable Rule 401 because it will not produce visible emissions of any air contaminant for a period(s) aggregating more than three minutes in an hour which is: (a) as dark or darker than the designated No. 1 on the Ringelmann Chart, or (b) of such opacity as to obscure an observer's view to a degree equal to or greater than does smoke as described in (a) above.
• Rule 403 Fugitive Dust	Applicable to particulate matter due to construction/excavation. Installation of groundwater wells will comply with fugitive dust regulations; particulate matter will not exceed 50 $\mu\text{g}/\text{m}^3$.	Applicable to particulate matter due to construction/excavation. Installation of SVE system will comply with fugitive dust regulations; particulate matter will not exceed 50 $\mu\text{g}/\text{m}^3$.	Applicable to particulate matter due to excavation. Excavation and soil handling will comply with fugitive dust regulations; particulate matter will not exceed 50 $\mu\text{g}/\text{m}^3$.	Applicable to particulate matter due to construction/excavation. Excavation and soil handling will comply with fugitive dust regulations; particulate matter will not exceed 50 $\mu\text{g}/\text{m}^3$.	Applicable to particulate matter due to construction/excavation. Excavation and soil handling will comply with fugitive dust regulations; particulate matter will not exceed 50 $\mu\text{g}/\text{m}^3$.

1 Perched water extracted under Alternative 2B will be treated and discharged under the selected remedy for groundwater. Refer to Table 7-1 for ARARs pertaining to perched water treatment and discharge.

TABLE 7-2 (continued)

COMPARATIVE ANALYSIS OF COMPLIANCE WITH ARARS
SOILS ALTERNATIVES

ARAR	Alternative 2B Perched Zone Dewatering	Alternative 2C/3D In Situ SVE	Alternative 3B/4B Excavation Off-site Disposal	Alternative 3C Excavation/Ex Situ SVE On-base Use	Alternative 4C Excavation/Ex Situ SVE Off-site Disposal
<p>• Rule 404 Particulate Matter</p>	NA to dewatering; refer to Table 7-1 for groundwater treatment alternatives.	SVE will comply with applicable Rule 404; particulate matter will not be discharged in excess of the discharge particulate matter standard that corresponds to the volume of emissions discharged (determined as dry gas) or in excess of 450 milligrams per cubic meter in emissions (as dry gas). The volume of emissions will be determined during design.	NA	SVE will comply with applicable Rule 404; particulate matter will not be discharged in excess of the discharge particulate matter standard that corresponds to the volume of emissions discharged (determined as dry gas) or in excess of 450 milligrams per cubic meter in emissions (as dry gas). The volume of emissions will be determined during design.	SVE will comply with applicable Rule 404; particulate matter will not be discharged in excess of the discharge particulate matter standard that corresponds to the volume of emissions discharged (determined as dry gas) or in excess of 450 milligrams per cubic meter in emissions (as dry gas). The volume of emissions will be determined during design.
<p>• Rule 408 Circumvention</p>	NA to dewatering; refer to Table 7-1 for groundwater treatment alternatives.	The SVE alternative will not include equipment that would, without a reduction in the total release of air contaminants to the atmosphere, reduce or conceal an emission that would otherwise violate SCAQMD rules or Chapter 3, Part 4, Division 26 of the Health and Safety Code; SVE will comply with this applicable rule.	NA	The SVE alternative will not include equipment that would, without a reduction in the total release of air contaminants to the atmosphere, reduce or conceal an emission that would otherwise violate SCAQMD rules or Chapter 3, Part 4, Division 26 of the Health and Safety Code; SVE will comply with this applicable rule.	The SVE alternative will not include equipment that would, without a reduction in the total release of air contaminants to the atmosphere, reduce or conceal an emission that would otherwise violate SCAQMD rules or Chapter 3, Part 4, Division 26 of the Health and Safety Code; SVE will comply with this applicable rule.

1 Perched water extracted under Alternative 2B will be treated and discharged under the selected remedy for groundwater. Refer to Table 7-1 for ARARs pertaining to perched water treatment and discharge.

TABLE 7-2 (continued)

COMPARATIVE ANALYSIS OF COMPLIANCE WITH ARARS
SOILS ALTERNATIVES

ARAR	Alternative 2B Perched Zone Dewatering	Alternative 2C/3D In Situ SVE	Alternative 3B/4B Excavation Off-site Disposal	Alternative 3C Excavation/Ex Situ SVE On-base Use	Alternative 4C Excavation/Ex Situ SVE Off-site Disposal
<ul style="list-style-type: none"> • Rule 1166 VOC Emissions from Decontam- ination of Soil 	NA	Applicable to emissions from soil registering 50 ppm or greater VOCs when measured with an organic vapor analyzer. SVE emissions of TCE will comply through the use of SVE as the Best Available Control Technology (BACT); the Rule will be complied with.	Applicable to emissions from soil registering 50 ppm or greater VOCs when measured with an organic vapor analyzer. TCE emissions due to excavation will be mitigated with SCAQMD-approved soil control measures; the Rule will be complied with.	Applicable to emissions from soil registering 50 ppm or greater VOCs when measured with an organic vapor analyzer. SVE emissions of TCE will comply through the use of SVE as the Best Available Control Technology (BACT); emissions of TCE due to excavation will be mitigated with SCAQMD-approved soil control measures. The Rule will be complied with.	Applicable to emissions from soil registering 50 ppm or greater VOCs when measured with an organic vapor analyzer. SVE emissions of TCE will comply through the use of SVE as the BACT; emissions of TCE due to excavation will be mitigated with SCAQMD-approved soil control measures. The Rule will be complied with.

1 Perched water extracted under Alternative 2B will be treated and discharged under the selected remedy for groundwater. Refer to Table 7-1 for ARARs pertaining to perched water treatment and discharge.

TABLE 7-2 (continued)
COMPARATIVE ANALYSIS OF COMPLIANCE WITH ARARS
SOILS ALTERNATIVES

ARAR	Alternative 2B Perched Zone Dewatering	Alternative 2C/3D In Situ SVE	Alternative 3B/4B Excavation Off-site Disposal	Alternative 3C Excavation/Ex Situ SVE On-base Use	Alternative 4C Excavation/Ex Situ SVE Off-site Disposal
<p>• Regulation XIII Rule 1303 - New Source Review</p>	NA	<p>Rule 1303 (a) is applicable to net increases in emissions of VOCs that can result in ozone. Due to the low VOC soil concentrations, emissions will be below the 1 lb/day limit requiring use of Best Available Control Technology (BACT) to limit emission increases (SCAQMD considers an emissions increase to be an increase of at least 1 lb/day). However, the SVE unit will be equipped with a vapor-phase carbon adsorption unit for treatment of emissions which will be used if direct discharge does not comply with air quality ARARs (carbon adsorption is BACT for SVE emissions). The AF will consult with the SCAQMD regarding emissions offsets required in Rule 1303 (b) during design.</p>	NA	<p>Rule 1303 (a) is applicable to net increases in emissions of VOCs that can result in ozone. Due to the low VOC soil concentrations, emissions will be below the 1 lb/day limit requiring use of Best Available Control Technology (BACT) to limit emission increases (SCAQMD considers an emissions increase to be an increase of at least 1 lb/day). However, the SVE unit will be equipped with a vapor-phase carbon adsorption unit for treatment of emissions which will be used if direct discharge does not comply with air quality ARARs (carbon adsorption is BACT for SVE emissions). The AF will consult with the SCAQMD regarding emissions offsets required in Rule 1303 (b) during design.</p>	<p>Rule 1303 (a) is applicable to net increases in emissions of VOCs that can result in ozone. Due to the low VOC soil concentrations, emissions will be below the 1 lb/day limit requiring use of Best Available Control Technology (BACT) to limit emission increases (SCAQMD considers an emissions increase to be an increase of at least 1 lb/day). However, the SVE unit will be equipped with a vapor-phase carbon adsorption unit for treatment of emissions which will be used if direct discharge does not comply with air quality ARARs (carbon adsorption is BACT for SVE emissions). The AF will consult with the SCAQMD regarding emissions offsets required in Rule 1303 (b) during design.</p>

1 Perched water extracted under Alternative 2B will be treated and discharged under the selected remedy for groundwater. Refer to Table 7-1 for ARARs pertaining to perched water treatment and discharge.

TABLE 7-2 (continued)

COMPARATIVE ANALYSIS OF COMPLIANCE WITH ARARs
SOILS ALTERNATIVES

ARAR	Alternative 2B Perched Zone Dewatering	Alternative 2C/3D In Situ SVE	Alternative 3B/4B Excavation Off-site Disposal	Alternative 3C Excavation/Ex Situ SVE On-base Use	Alternative 4C Excavation/Ex Situ SVE Off-site Disposal
• Rule 1401 - New Source Review of Carcinogenic Air Contaminants	NA	Applicable to emissions of TCE, a regulated carcinogenic air contaminant, from new sources (SVE unit). Compliance will be achieved because TCE emissions will be below the 1×10^{-6} risk level (by vapor-phase carbon treatment if necessary). Substantive requirements pertaining to permits will be met.	NA	Applicable to emissions of TCE, a regulated carcinogenic air contaminant, from new sources (SVE unit). Compliance will be achieved because TCE emissions will be below the 1×10^{-6} risk level (by vapor-phase carbon treatment if necessary). Substantive requirements for permits will be met.	Applicable to emissions of TCE, a regulated carcinogenic air contaminant, from new sources (SVE unit). Compliance will be achieved because TCE emissions will be below the 1×10^{-6} risk level (by vapor-phase carbon treatment if necessary). Substantive requirements for permits will be met.
Water Quality Objectives (Water Quality Control Plan, Santa Ana River Basin Plan)	The presence of TCE in soil could affect groundwater. Although it is not a discharge to waters of the state, water quality objectives are relevant and appropriate. The removal of TCE from soil will comply with the water quality objective for toxicity that requires waters to be kept free of contaminants in concentrations toxic to or that produce detrimental physiological responses in humans.	The presence of TCE in soil could affect groundwater. Although it is not a discharge to waters of the state, water quality objectives are relevant and appropriate. Removal of TCE from soil will comply with the water quality objective for toxicity that requires waters to be kept free of contaminants in concentrations toxic to or that produce detrimental physiological responses in humans.	The presence of TCE or TCE and chromium in soil could affect groundwater. Although it is not a discharge to waters of the state, water quality objectives are relevant and appropriate. Removal of contaminants from the site will comply with the water quality objective for toxicity that requires waters to be kept free of contaminants in concentrations toxic to or that produce detrimental physiological responses in humans.	The presence of TCE in soil could affect groundwater. Although it is not a discharge to waters of the state, water quality objectives are relevant and appropriate. Removal of TCE from soil will comply with the water quality objective for toxicity that requires waters to be kept free of contaminants in concentrations toxic to or that produce detrimental physiological responses in humans.	The presence of TCE and chromium in soil could affect groundwater. Although it is not a discharge to waters of the state, water quality objectives are relevant and appropriate. Removal of TCE and chromium from the site will comply with the water quality objective for toxicity that requires waters to be kept free of contaminants in concentrations toxic to or that produce detrimental physiological responses in humans.

1 Perched water extracted under Alternative 2B will be treated and discharged under the selected remedy for groundwater. Refer to Table 7-1 for ARARs pertaining to perched water treatment and discharge.

cleanup standard is achieved, and the AF will provide notice of this restriction in any purchase, lease, or other agreement relating to that property. The AF will continue to perform quarterly monitoring of selected groundwater wells in the perched zone and underlying upper aquifer to detect possible migration of TCE from the perched zone into the underlying groundwater (water table and/or perched zone) and to monitor water levels.

Perched zone dewatering locations, flowrates, and specifications will be determined in the RD phase through engineering and design. Changes in water level or resaturation of the perched zone will be accounted for in the design. Because the perched zone is currently unsaturated and infiltration is limited, dewatering is expected to occur infrequently. Dewatering will be activated when water levels reach a preset point. The remedy will comply with the Water Quality Objective in the Santa Ana River Basin Water Quality Control Plan and, under the selected groundwater remedy, RCRA regulations regarding tank systems established in Title 22 CCR §§66364.190-66264.199. Groundwater wells will be installed in accordance with the TBC Water Well Standards, Bulletin 74-90.

Any extracted perched zone water containing TCE above the groundwater cleanup standard will be treated by the selected groundwater remedy to levels no greater than the cleanup standard. Extracted perched zone water containing TCE at or below the cleanup standard will be disposed with treated groundwater.

This remedy protects groundwater resources by monitoring for and removing a potential driving force of TCE migration into groundwater. The estimated time to implement this remedy and to meet the cleanup standard is 30 years. The total cost for the 30-year period is \$1,740,000.

ALTERNATIVE 2C - IN SITU SVE

- Deed restrictions
- Groundwater monitoring
- Treatment by in situ SVE
- Treatment of emissions by vapor-phase carbon adsorption, or no treatment if emissions are in compliance with air quality ARARs

Prior to sale or transfer of any Norton AFB property overlying deep subsurface soil contamination, the AF will record a land use restriction in accordance with California Health and Safety Code §25230 as an institutional control to prohibit excavation until after the deep subsurface soil cleanup standards have been achieved, and the AF will provide notice of this restriction in any purchase, lease, or other agreement relating to that property. The AF will continue to perform quarterly monitoring of selected groundwater wells to detect possible migration of TCE from the deep subsurface soils into the underlying groundwater (water table and/or perched zone) and to monitor water levels.

SVE locations, flowrates, and other specifications will be determined in the RD phase through engineering design and analysis of treatability study data, and compliance with Rule 1303, New Source Review. A treatability study will be performed to determine the ability of SVE to remove TCE from deep soil and to provide criteria necessary for system design. The extraction system will be designed to remove TCE in deep subsurface soils to the cleanup standard. The remedy will comply with transportable treatment unit standards established in Title 22 CCR Division 4.5 Chapter 45 §67450 that are applicable to a transportable SVE unit. By removing TCE from soil, this remedy will comply with the Water Quality Objective in the Santa Ana River Basin Water Quality Control Plan.

During the remedy design, the AF will consult with SCAQMD to ensure compliance with air quality ARARs including SCAQMD Rule 1166 which is applicable to TCE emissions from the soil and SCAQMD Rule 1401 which is applicable to risk levels posed by SVE emissions. The remedy will also comply with the non-legally binding policy in the Statement of Policy on Control of Air Stripper Emissions (OSWER Dir. 9355.028) that provides hourly, daily, and yearly facility-wide emission levels that apply to SVE units. The SVE system will include built-in vapor-phase carbon units as emission controls. If untreated emissions are in compliance with air quality ARARs, emissions treatment will not be necessary. The Air Force will measure emission levels during the test runs in the design phase to ensure compliance with SCAQMD Rule 1303. Extracted soil vapor containing TCE will meet air quality ARARs by one of the following options:

- No Treatment. No soil vapor treatment will be used if levels of TCE in extracted soil vapor meet air quality ARARs.
- Carbon Adsorption. Soil vapor will be treated by vapor-phase carbon adsorption if SVE treatability data indicate that the levels of TCE in extracted soil vapor do not meet air quality ARARs. Specifications will be determined in the RD phase through engineering design and analysis of emissions data collected during the SVE treatability study. The system will be designed to remove TCE in vapor such that emissions meet air quality ARARs. Spent GAC will be transported offsite by the carbon vendor. The carbon vendor is responsible for determining whether the carbon is regenerated or disposed. Before being transported offsite, spent carbon will be tested to determine whether it is a RCRA hazardous waste as defined in Title 22 CCR Division 4.5 §66261. If spent carbon is determined a hazardous waste, RCRA regulations for generators of hazardous waste (Title 22 CCR Division 4.5 §66262.34) are applicable. Spent GAC will be transported in compliance with regulations pertaining to off-site transportation. Any risk to human health and the environment is reduced. The estimated capital cost for a representative vapor-phase carbon system is \$80,000, and \$59,000 per year for operations and maintenance (O&M).

During SVE treatment, soil vapor will be monitored for vinyl chloride that may be present due to its presence in groundwater. If detected above the 0.2 parts per million by volume (ppmv) indoor air cleanup standard, buildings in the vicinity will be monitored. Buildings with indoor concentrations above the cleanup standard will be fitted with ventilation systems.

Following SVE treatment, continued quarterly groundwater monitoring will be necessary to demonstrate effectiveness of the remedial action by monitoring for migration into groundwater of any residual TCE remaining after SVE treatment.

This remedy protects groundwater resources by removing a potential driving force of TCE migration into groundwater. The estimated time to implement this remedy and to meet the cleanup standard is 18 months. The total cost for a treatability study and 18 months of in situ SVE treatment is \$2,370,000 (excluding emission controls).

7.2.2 SHALLOW SUBSURFACE SOILS (TCE ONLY)

Approximately 5,650 cy of shallow subsurface soil contain only TCE: 490 cy at Building 658 and 5,160 cy at Building 763 (estimated total from five separate shop areas). The volume of shallow subsurface soil affected with TCE only was determined through RI data. There is no current risk to human health due to direct contact with soil containing TCE. TCE in soil poses a potential future threat to human health and a threat to the environment. The environmental risk is to groundwater

because TCE in shallow subsurface soils may potentially affect the groundwater. There are four TCE-only shallow subsurface soil alternatives (Fig. 7-3). The ARARs for each alternative are identified in Table 7-2. The text highlights major ARARs only.

Soil at Norton AFB contains TCE and other VOCs. The situation at Norton AFB is sufficiently similar to other situations for which the RCRA requirements for treatment, storage, and disposal were designed, and therefore the RCRA requirements for treatment, storage, and disposal are applicable for the TCE-containing material. Specifically, the RCRA "contained-in" policy would apply. Soil containing TCE must be handled as if it were a hazardous waste until the soil no longer contains the listed waste. At Norton AFB, it has been determined that if the soil are treated to the cleanup standards of 5 µg/L (ppb) in leachate, the soil will no longer be considered to contain a listed waste and need not be handled as a hazardous waste.

ALTERNATIVE 3A - NO ACTION

This alternative, required for consideration by the NCP, involves no remedial actions to address shallow subsurface soil contaminated with TCE only. No action is implemented. This alternative will not comply with the Water Quality Objective stated in the Santa Ana River Basin Water Quality Control Plan due to possible impacts to groundwater from TCE in soil. This alternative will not reduce the risk to the environment posed by the TCE in shallow subsurface soils.

ALTERNATIVE 3B - EXCAVATION AND OFF-SITE DISPOSAL

- Demolition and reconstruction of existing facilities
- Excavation of soil containing TCE only above the cleanup standard
- Backfill of excavation with clean import or borrow soil
- Testing of excavated soil
- Transportation of soil offsite by licensed transporter
- Disposal offsite to a licensed Subtitle C disposal facility

Shallow subsurface soil containing TCE only above the cleanup standard is excavated. Excavation will require demolition and reconstruction of sections of the Electroplating, Paint, Maintenance, and Tire Shops in Building 763 to access the affected soil. During excavation, dust suppression measures will be taken to control dust emissions. Following excavation, the areas will be backfilled with clean import or borrow soil, compacted, and restored to its previous condition.

The excavated soil is immediately loaded onto trucks licensed for the transport of contaminated soils, and transferred to a licensed Subtitle C disposal facility. The soil will be treated at the disposal facility if the soil does not meet the disposal standards. The disposal facility will be identified during the RD phase. Soil will be transported in compliance with regulations pertaining to off-site transportation. Selection of a disposal facility may affect transportation and disposal costs but will not affect selection of this remedy.

Residual TCE below cleanup standards may remain at the site. These levels will not pose a risk to human health or the environment, therefore long-term management or controls for any residual TCE are not necessary.

This remedy protects groundwater resources by removing a potential driving force of TCE migration into groundwater. The estimated time to implement this remedy and to meet the cleanup standard is 6 months. The total cost for the 6-month period is \$4,480,000.

**ALTERNATIVE 3A
NO ACTION**

Risk to groundwater remains

**ALTERNATIVE 3B
EXCAVATION AND
OFF-SITE
DISPOSAL**

Total Cost \$4.48M

Demolition and Reconstruction	Excavation and Backfill	Testing and Off-site Disposal
<ul style="list-style-type: none"> Demolition and reconstruction of existing facilities at Building 763 required No demolition necessary at Building 658 	<ul style="list-style-type: none"> Excavate 490 cy of soil at Building 658 and 5,160 cy at Building 763 containing TCE above cleanup standards Groundwater risk reduced Backfill excavation with clean import or borrow soil 	<ul style="list-style-type: none"> Test soil to determine if is a RCRA hazardous waste Transport soil offsite by licensed transporter Disposal off-site to a licensed Subtitle C disposal facility Remedy accomplished in 6 months

**ALTERNATIVE 3C
EXCAVATION/
EX SITU SVE /
ON-BASE USE OF
TREATED SOIL**

Total Cost \$2.68M
(excluding emission control)

Demolition and Reconstruction	Excavation and Backfill	Ex Situ SVE	On-base Use
<ul style="list-style-type: none"> Demolition and reconstruction of existing facilities at Building 763 required No demolition necessary at Building 658 	<ul style="list-style-type: none"> Excavate 490 cy of soil at Building 658 and 5,160 cy at Building 763 containing TCE above cleanup standards Groundwater risk reduced Backfill excavation with clean import or borrow soil 	<ul style="list-style-type: none"> On-site treatment of commingled TCE to reduced levels to cleanup standard Residual risk less than 10^{-6} for TCE SVE off-gas will comply with air quality ARARs through treatment by vapor-phase carbon adsorption, or no treatment if untreated emissions are in compliance 	<ul style="list-style-type: none"> Test soil to to ensure cleanup standard is achieved Use onbase for landscaping or construction purposes Remedy accomplished in 6 months

**ALTERNATIVE 3D
IN SITU SVE**

Total Cost \$1.06M
(excluding emission control)

Deed Restrictions	Groundwater Monitoring	In Situ SVE	Emission Treatment
<ul style="list-style-type: none"> Deed restrictions on Norton AFB property overlying deep soil contamination until cleanup standards are attained 	<ul style="list-style-type: none"> Quarterly groundwater monitoring of perched zone and underlying aquifer to monitor water levels, possible migration of TCE in soil, and effectiveness of treatment 	<ul style="list-style-type: none"> Treatment for 1 year to meet cleanup standards Residual Risk less than 10^{-6} 	<ul style="list-style-type: none"> SVE off-gas will comply with air quality ARARs through treatment by vapor-phase carbon adsorption, or no treatment if untreated emissions are in compliance

M = million dollars

NORTON AIR FORCE BASE

Shallow Subsurface Soil (TCE only) Alternatives

ALTERNATIVE 3C - EXCAVATION/EX SITU SVE/ON-BASE USE OF TREATED SOIL

- Demolition and reconstruction of existing facilities
- Excavation of soil containing TCE only above the cleanup standard
- Test soil for levels of TCE
- Backfill of excavation with clean import or borrow soil
- Transportation onsite to treatment location
- Treatment by ex situ SVE
- Treatment of emissions by vapor-phase carbon adsorption, or no treatment if emissions are in compliance with air quality ARARs
- On-base use of treated soil

Refer to Alternative 3B for a description of demolition, reconstruction, excavation, and backfill elements of this alternative.

The excavated soil is immediately loaded onto trucks and transported to a pre-determined location onsite for treatment by ex situ SVE. A soil pile will be constructed with pre-packed and constructed extraction pipes placed horizontally through the pile, and covered and underlain by an impermeable liner to prevent uncontrolled volatilization of TCE. Specifications for the ex situ SVE system will be determined in the RD phase and will be in compliance with Rule 1303, New Source Review. During the remedy design, the AF will consult with SCAQMD to ensure compliance with all quality ARARs including SCAQMD Rule 1166 which is applicable to TCE emissions from soil and SCAQMD Rule 1401 which is applicable to risk levels posed by SVE emissions. The extraction system will be designed to remove TCE in excavated shallow subsurface soils to the cleanup standard. Treated soil will be tested to ensure treatment is complete.

Vapor-phase carbon will be part of the SVE system as air emission controls. Extracted soil vapor containing TCE will meet air quality ARARs by use of vapor-phase carbon or direct discharge as described under Alternative 2C, Sect. 7.2.1.

Treated soil is reused onbase for landscaping or construction purposes.

This remedy protects groundwater resources by removing a potential driving force of TCE migration into groundwater. By removing TCE from soil, this remedy will comply with the Water Quality Objective stated in the Santa Ana River Basin Water Quality Control Plan. Residual TCE below the cleanup standard may remain in the unexcavated soil and may be present in the treated soil, but these levels will not pose a risk to human health or the environment. Long-term management or control of the soil containing any residual TCE is not necessary. The estimated time to implement this remedy and to meet the cleanup standard is 6 months. The total cost for the 6-month period is \$2,680,000 (excluding emission controls).

ALTERNATIVE 3D - IN SITU SVE

- Deed restrictions
- Groundwater monitoring
- Treatment by in situ SVE
- Treatment of emissions by vapor-phase carbon adsorption, or no treatment if emissions are in compliance with air quality ARARs

Refer to Sect. 7.2.1, Alternative 2C, for a description of each element of this alternative.

This remedy protects groundwater resources by removing a potential driving force of TCE migration into groundwater. The estimated time to implement this remedy and to meet the cleanup standard is 1 year. The total cost for a treatability study and in situ SVE treatment for the 1-year period is \$1,055,000 (excluding emission controls).

7.2.3 SHALLOW SUBSURFACE SOILS (TCE AND CHROMIUM)

Approximately 415 cy of shallow subsurface soil contain chromium commingled with TCE. The volume of shallow subsurface soil affected with chromium commingled with TCE was determined through RI data. The concentration of chromium in soil presents a carcinogenic and noncarcinogenic risk to human health due to ingestion and dermal contact; however there is no current risk to human health due to TCE. TCE in soil poses a potential future threat to human health and a threat to the environment. The environmental risk is to groundwater because TCE in shallow subsurface soils may potentially affect the groundwater. There are three TCE and chromium shallow subsurface soil alternatives (Fig. 7-4). The ARARs for each alternative are identified in Table 7-2. The text highlights the major ARARs only.

The contaminated soil is a listed RCRA waste ("contained-in" policy) due to TCE and may be a RCRA characteristic waste based on toxicity due to chromium because the maximum detection of chromium exceeds the total concentration toxicity criteria of 5,000 mg/kg. The soil will be tested for both TCE and chromium to determine whether it is a RCRA hazardous waste, as described in Title 22 CCR Division 4.5 Chapter 11 §66261. The toxicity criteria for the soluble concentration of chromium is 5 mg/L.

ALTERNATIVE 4A - NO ACTION

This alternative, required for consideration by the NCP, involves no remedial actions to address shallow subsurface soil contaminated with TCE and chromium commingled. No action is implemented. This alternative will not comply with the Water Quality Objective stated in the Santa Ana River Basin Water Quality Control Plan due to possible impacts to groundwater from TCE in soil. This alternative will not reduce the risk to human health posed by the chromium in shallow subsurface soil, or to the environment posed by the TCE in shallow subsurface soils.

ALTERNATIVE 4B - EXCAVATION AND OFF-SITE DISPOSAL

- Demolition and reconstruction of existing facilities
- Excavation of soil containing chromium commingled with TCE above the cleanup standards
- Test soil to determine levels of TCE and chromium
- Backfill of excavation with clean import or borrow soil
- Testing of excavated soil
- Transportation of soil offsite by licensed transporter
- Disposal offsite to a licensed Subtitle C disposal facility.

Refer to Sect. 7.2.2, Alternative 3B, for a description of each element of this alternative. Excavation will require demolition and reconstruction of the Electroplating Shop and adjacent office.

The soil will be tested to determine whether it is a RCRA hazardous waste based on TCE concentrations and chromium toxicity. If the soil is considered a hazardous waste, RCRA generator standards (Title 22 CCR Division 4.5 §66262) are applicable to the excavated soil.

**ALTERNATIVE 4A
NO ACTION**

Cardinogenic and non-carcinogenic risk level from ingestion and dermal contact due to chromium remains; groundwater risk remains

**ALTERNATIVE 4B
EXCAVATION AND
OFF-SITE
DISPOSAL**

Total Cost \$1.22M

Demolition and Reconstruction	Excavation and Backfill	Testing, Transport, and Disposal
<ul style="list-style-type: none"> Demolition and reconstruction of existing facilities at Building 763 required 	<ul style="list-style-type: none"> Excavate 415 cy of soil at IRP site 9 containing TCE and chromium commingled above cleanup standards Residual carcinogenic and non-carcinogenic risk due to chromium reduced to less than 10^{-6}, and a hazard index less than one, respectively; groundwater risk reduced Backfill excavation with clean import or borrow soil 	<ul style="list-style-type: none"> Test soil to determine if is a RCRA hazardous waste Transport soil offsite by licensed transporter Disposal off-site to a licensed Subtitle C disposal facility Remedy accomplished in 6 months

**ALTERNATIVE 4C
EXCAVATION/
EX SITU SVE
FOR TCE/
OFF-SITE
DISPOSAL FOR
CHROMIUM**

Total Cost \$1.53M
(excluding emission control)

Demolition and Reconstruction	Excavation and Backfill	Ex Situ SVE	Testing, Transport, and Disposal
<ul style="list-style-type: none"> Demolition and reconstruction of existing facilities at Building 763 required 	<ul style="list-style-type: none"> Excavate 415 cy of soil at IRP site 9 containing TCE and chromium commingled above cleanup standards Residual carcinogenic and non-carcinogenic risk due to chromium reduced to less than 10^{-6}, and a hazard index less than one, respectively; groundwater risk reduced Backfill excavation with clean import or borrow soil 	<ul style="list-style-type: none"> On-site treatment of commingled TCE to reduced levels to cleanup standard Residual risk less than 10^{-6} for TCE SVE off-gas will comply with air quality ARARs through treatment by vapor-phase carbon adsorption, or no treatment if untreated emissions are in compliance 	<ul style="list-style-type: none"> Test soil to determine if is a RCRA hazardous waste Transport soil offsite by licensed transporter (chromium only) Disposal off site to a licensed Subtitle C disposal facility (chromium only) Remedy accomplished in 9 months

M = million dollars

NORTON AIR FORCE BASE

Shallow Subsurface Soil (TCE and Chromium) Alternatives

Soil will be transported to an off-site Subtitle C disposal facility. If the concentrations of chromium exceed land disposal restriction standards for chromium as a "D" level waste (500 µg/L in waste extract), treatment at the disposal facility will be performed.

This remedy reduces the risk to human health by removing the chromium in shallow subsurface soil, and to the environment by removing the TCE in shallow subsurface soils. The estimated time to implement this remedy and to meet cleanup standards is 6 months. The total cost for the 6-month period is \$1,220,000.

ALTERNATIVE 4C - EXCAVATION/EX SITU SVE FOR SOIL CONTAINING TCE/OFF-SITE DISPOSAL OF SOIL CONTAINING CHROMIUM

- Demolition and reconstruction of existing facilities
- Excavation of soil containing chromium commingled with TCE above the cleanup standards
- Test soil to determine levels of TCE and chromium
- Backfill of excavation with clean import or borrow soil
- *Transportation onsite to treatment location*
- Treatment of TCE only by ex situ SVE
- Treatment of emissions by vapor-phase carbon adsorption, or no treatment if emissions are in compliance with air quality ARARs
- Testing of treated soil containing chromium
- Transportation of treated soil containing chromium offsite by licensed transporter
- Disposal of treated soil containing chromium offsite to a licensed Subtitle C disposal facility

Refer to Sect. 7.2.2, Alternative 3B for a description of demolition, reconstruction, excavation, backfill, testing, off-site transportation, and off-site disposal elements of this alternative. Refer to Sect. 7.2.2, Alternative 3C for a description of on-site transportation and ex situ treatment elements of this alternative.

Soil will be transported to an off-site Subtitle C disposal facility. If the concentrations of chromium exceed land disposal restriction standards for chromium as a "D" (D007) level waste (LDR is 5 mg/L in waste extract), treatment at the disposal facility will be performed.

This remedy reduces the risk to human health by removing the chromium in shallow subsurface soil, and to the environment by removing and treating the TCE in shallow subsurface soils. The estimated time to implement this remedy and to meet cleanup standards is 9 months. The total cost for the 9-month period is \$1,529,000 (excluding emission controls).

During design of the remedy, the Air Force will coordinate with SCAQMD to ensure that any direct discharge is in compliance with SCAQMD Rule 1303 (applicable to 1,1,1-trichloroethane emissions and ozone produced by VOC emissions) limit of 1 lb/day based on cumulative emissions of all air strippers. The Air Force will measure emission levels during the test runs in the design phase to ensure compliance with SCAQMD Rule 1303.

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8.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Media-specific alternatives are evaluated to determine which alternative provides the "best balance" of tradeoffs with respect to the nine evaluation criteria required by the NCP and CERCLA Section 121:

- (1) Overall Protection of Human Health and the Environment
- (2) Compliance with ARARs
- (3) Long-term Effectiveness and Permanence
- (4) Reduction of Toxicity, Mobility, or Volume Through Treatment
- (5) Short-term Effectiveness
- (6) Implementability
- (7) Cost
- (8) State Acceptance
- (9) Community Acceptance.

8.1 GROUNDWATER

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment

Alternatives 1B and 1C would be protective of human health and the environment through reduction of VOC concentration to below MCLs. The risk to human health from ingestion of groundwater and inhalation of airborne vapors from groundwater is reduced from 7.1×10^{-6} to 1×10^{-6} (Cal-EPA slope factors). The risk to the environment from groundwater degradation is also reduced. Alternative 1A is not protective of human health and the environment because it does not reduce risks to acceptable levels.

Compliance with ARARS

Alternatives 1B and 1C would comply with chemical-specific, location-specific, and action-specific ARARs. Alternative-specific ARAR compliance is discussed in Sect. 7.0 and presented in Table 7-1.

According to the decision of the EPA Administrator in the Mather and George AFB disputes, Resolution 68-16, the water anti-degradation policy, is an ARAR for reinjection of treated groundwater into clean areas (i.e., high quality waters) of the aquifer (i.e., outside of the contaminated plume). The numerical limit established on a monthly median and daily maximum basis to meet the requirements of Resolution 68-16 are 0.5 and 5.0 micrograms/liter, respectively, for each of the groundwater contaminants listed on Table 9-1. With respect to the reinjection of treated groundwater within the contaminated plume, treatment shall be at least to the concentration level of the contaminants of concern in the groundwater at the point of reinjection measured on a monthly median basis, but not greater than the groundwater cleanup standards set forth in Table 9-1. To meet the requirement that the selected remedy be protective of human health and the environment, the Air Force shall maintain hydraulic control to the extent possible of the plume while extracting contaminated groundwater, and reinjecting treated groundwater into the contaminant plume or the clean portion of the aquifer.

The State has asserted that the Water Quality Objectives for the Santa Ana River Basin Water Quality Control Plan and State Water Resources Control Board Resolution No. 68-16 are ARARs for

PRIMARY BALANCING CRITERIA

Long-Term Effectiveness and Permanence

Alternatives 1B and 1C would mitigate any potential future risks by preventing the migration of VOCs in groundwater, and by restoring the groundwater quality of the upper water-bearing zone. Long-term monitoring, operation, and maintenance would be required. Long-term effectiveness and permanence is anticipated to be achieved most effectively by implementing Alternative 1B.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 1B and 1C would reduce contaminants at the site through extraction and treatment of contaminated groundwater. Alternative 1B would not result in permanent reduction of the toxicity, mobility, and volume of VOCs because VOCs are released into the atmosphere. Although the toxicity, mobility, or volume of VOCs discharged to the air would not be reduced unless the carbon adsorption emission controls are used, any discharge of VOCs to the atmosphere will be in compliance with air emission ARARs and at levels that do not present a risk to public health and the environment. The risk would be 10^{-7} for a maximum predicted VOC emission of 0.078 lbs/day (equivalent to 3.25×10^{-3} lb/hr or 0.014 ton/yr). Alternative 1C would result in a permanent reduction of the toxicity, mobility, and volume of VOCs if the spent carbon is regenerated.¹

Short-Term Effectiveness

Alternatives 1B and 1C both provide short-term effectiveness. Risk associated with groundwater monitoring, extraction, treatment, and discharge are mitigated by the health and safety plan for the site. Alternative 1C would provide a lesser degree of short-term effectiveness because it requires additional handling and transportation of VOCs in the form of spent carbon.

The exact length of time required to achieve response action objectives cannot be predicted, but it is assumed to be at least 30 years for either alternative.

Implementability

Alternative 1B would utilize, in part, the existing groundwater extraction and treatment system which is being used as a treatability study in the area of highest VOC concentration. Additional extraction wells would be installed and a larger system would be built to treat the remaining groundwater plume. Alternative 1C would also utilize the existing extraction wells, but would require installing additional extraction wells and building a new treatment system to treat the VOC groundwater plume with liquid-phase carbon adsorption.

Cost

Under similar extraction scenarios (pumping rate, concentration, etc.) the present worth cost would be \$28,050,000 for Alternative 1B and \$133,060,000 for Alternative 1C. Alternative 1C would have a higher present worth cost due to the cost of replenishing, handling, and replacing carbon during the lifetime of the remedy. If emission controls become necessary for Alternative 1B to comply with ARARs, the present worth cost would increase to \$37,560,000 with vapor-phase activated carbon adsorption treatment.

¹ The carbon vendor supplies carbon as a service. The decision whether carbon is regenerated or disposed is made by the vendor.

MODIFYING CRITERIA

Community Acceptance

The PP was presented to the community (in English and Spanish) and discussed at a public meeting. The San Bernardino International Airport Authority agreed that the cleanup standard for TCE is protective of human health but that reinjection of the treated water outside of the plume should be treated to the lowest practical level that can be achieved with air stripping. The City of Riverside agreed with the proposed cleanup technologies and stated its interest in purchasing treated water (conditional). One concerned citizen requested placement of the extraction wells to impede migration. In general, the community stated no objection to the AF's preferred remedy (Alternative 1B) for groundwater.

State Acceptance

The State of California has reviewed the CBA OU FS and the PP. The State stated no objection to the AF's preferred remedy (Alternative 1B) for groundwater except that treated water reinjected outside of the plume should be treated to the lowest practical level that can be achieved with air stripping (State Resolution 68-16).

8.2 SOIL

8.2.1 DEEP SUBSURFACE SOIL

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment

Alternatives 2B and 2C would be protective of the environment through the reduction of the potential for further groundwater degradation. Alternative 2A is not protective of the groundwater resource. There is no direct contact risk to human health due to TCE in deep soil.

Compliance with ARARS

Alternatives 2B and 2C would comply with chemical-specific, location-specific, and action-specific ARARs. Alternative-specific ARAR compliance is discussed in Sect. 7.0 and presented in Table 7-2.

See also discussion of Chapter 15 under Section 8.2.2.

PRIMARY BALANCING CRITERIA

Long-Term Effectiveness and Permanence

Alternatives 2B and 2C would mitigate any potential future risk by preventing the migration of TCE in deep subsurface soils to the groundwater. Alternative 2C would provide a higher degree of long-term effectiveness and permanence by permanently removing TCE from the soil. Some residual TCE would remain in the deep subsurface soil, but the levels would be below the cleanup standard and would not require long-term monitoring (treatability data will help determine the level of TCE removal, refer to Sect. 7.2.1). Alternative 2B would provide less long-term effectiveness and controls. Dewatering would not greatly reduce the volume of TCE in soil because very little TCE

would be removed. Therefore, long-term monitoring, maintenance, and operation would be required.

Reduction of Toxicity, Mobility or Volume Through Treatment

Alternatives 2B and 2C would reduce contaminants at the site. Alternative 2C would reduce the toxicity, mobility, and volume of TCE in deep soils by removing the TCE vapor. Although the toxicity, mobility, or volume of VOCs discharged to the air would not be reduced unless carbon emissions controls are used, any discharge of VOCs to the atmosphere will be in compliance with air emission ARARs and at levels that do not present a risk to public health and the environment. Alternative 2C would result in permanent reduction of the toxicity, mobility, and volume of TCE only if soil vapor is treated to comply with air quality ARARs.

Alternative 2B would reduce the mobility of TCE in soil by removing the driving force (perched water). Perched water may wash some TCE from soil, thereby reducing the volume and toxicity of TCE in deep soils. Permanent reduction of the TCE would depend on the selected remedy.

Short-Term Effectiveness

Alternatives 2B and 2C both provide short-term effectiveness. Risk associated with groundwater monitoring, perched water extraction, SVE, treatment, and discharge are mitigated by the health and safety plan for the site. Alternative 2B would provide a lesser degree of short-term effectiveness because the perched zone would only be dewatered when perched water is present. Site data indicate that this would occur infrequently.

Alternative 2C would require 18 months to achieve the cleanup standard to the maximum practicable extent. Alternative 2B would require 30 years to achieve the cleanup standard (or the time required to achieve groundwater cleanup standards).

Implementability

Alternative 2B would utilize existing monitoring wells and equipment at the site. The selected groundwater remedy would be utilized to treat extracted perched zone water above the cleanup standard. Groundwater monitoring and dewatering actions would continue after base closure and would require agreements between the new owner(s) and the AF to continue operation after base closure. Alternative 2C would require installing SVE wells and a treatment system to treat extracted soil vapor. Operational requirements for a SVE system would be more complex than those for dewatering.

Cost

The total present worth cost would be \$1,740,000 for Alternative 2B and \$2,370,000 for Alternative 2C. The cost of Alternative 2B would be less than Alternative 2C because dewatering would occur infrequently and treatment would be accommodated under the selected groundwater remedy. The cost of Alternative 2C would be higher due to cost associated with building an extraction system and analytical costs for monitoring the progress of cleanup.

MODIFYING CRITERIA

Community Acceptance

The PP was presented to the community (in English and Spanish) and discussed at a public meeting. The community stated no objection to the AF's preferred remedy (Alternative 2C) for deep subsurface soils.

State Acceptance

The State of California has reviewed the CBA OU FS and the PP. The State stated no objection to the AF's preferred remedy (Alternative 2C) for deep subsurface soils.

8.2.2 SHALLOW SUBSURFACE SOILS (TCE ONLY)

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment

Alternatives 3B, 3C, and 3D would be protective of the environment through reduction of the potential for further groundwater degradation. Alternative 3A is not protective of the environment because it allows the potential for further groundwater degradation. There is a potential future risk to human health due to TCE in shallow soil.

Compliance with ARARS

Alternatives 3B, 3C, and 3D would comply with chemical-specific, location-specific, and action-specific ARARS. Alternative-specific ARAR compliance is discussed in Sect. 7.0 and presented in Table 7-2.

The State has asserted that Title 23 of the California Code of Regulations, Division 3, Chapter 15, Section 2524 is an ARAR for the soil alternatives for Alternatives 2C/3D and 3C. USEPA does not agree, and therefore it is not listed as an ARAR for this ROD. The State, however, will not invoke dispute resolution, because all parties have agreed on the soil cleanup standard for TCE of 5 micrograms/liter leachate concentration based on protection of groundwater quality. Section 2524 defines "inert waste" as not containing hazardous waste or soluble pollutants at concentrations in excess of applicable water quality objectives. The State agrees that soil which when tested is at or below the soil cleanup standard for TCE will be an "inert waste" at this site.

PRIMARY BALANCING CRITERIA

Long-Term Effectiveness and Permanence

Alternatives 3B, 3C, and 3D would mitigate any potential future risk by preventing the migration of TCE in shallow subsurface soils to the groundwater. Alternative 3C would provide a high degree of long-term protectiveness and permanence by permanently removing TCE above the cleanup standard from the site through excavation. No risk to groundwater would remain from any residual TCE; management and controls would not be required. Excavated soil would be treated to achieve the cleanup standard and would be demonstrated to be a non-hazardous and non-designated waste before disposal onsite; no long-term monitoring or controls would be required.

Alternative 3B would also provide a high degree of long-term protectiveness and permanence by permanently removing TCE above the cleanup standard from the site through excavation. Long-term effectiveness and permanence would be achieved if soil is treated at the Subtitle C disposal facility. However, off-site disposal of untreated waste would not address the NCP preference for on-site treatment.

Alternative 3D would provide a lesser degree of long-term effectiveness and permanence by permanently removing TCE from the soil. Some residual TCE below the cleanup standard would remain in the shallow subsurface soil, but the levels that would remain would not require long-term monitoring.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 3B, 3C, and 3D would reduce contaminants at the site. Alternatives 3C and 3D would reduce the toxicity, mobility, and volume of TCE in shallow subsurface soils by removing the TCE vapor. Although the toxicity, mobility or volume of VOCs discharged to the air would not be reduced unless the carbon adsorption emissions controls are used, any discharge to the atmosphere will be in compliance with air emissions ARARs and at levels that do not present a risk to public health and the environment. Both alternatives would result in permanent reduction of the toxicity, mobility, and volume of TCE only if soil vapor is treated to comply with air quality ARARs. Alternative 3B would reduce the toxicity, mobility, and volume of shallow soils containing TCE at the site, but would only result in permanent reduction in toxicity, mobility, and volume of the TCE if treatment is performed at the receiving Subtitle C facility.

Short-Term Effectiveness

Alternatives 3B, 3C, and 3D provide short-term effectiveness. Risk associated with groundwater monitoring, excavation, SVE, treatment, discharge, and disposal are mitigated by the health and safety plan for the site. Alternatives 3B and 3C would provide greater short-term effectiveness because excavation immediately removes the contaminated material from the site. Alternative 3C would provide a lesser degree of short-term effectiveness of the two because the excavated soil must also be treated onsite. Alternative 3D provides the least short-term effectiveness because treatment in situ would require the longest time period to achieve the cleanup standard.

Alternatives 3B and 3C would require 6 months to achieve the cleanup standard, primarily due to demolition and reconstruction activities. Alternative 3D would require 1 year to achieve the cleanup standard.

Implementability

Alternatives 3B and 3C would be the most practical to implement at Building 658, but the least practical to implement at Building 763. At Building 658, affected soil is located outside the building, allowing for easy use of conventional excavation equipment. At Building 763, however, affected soil is located beneath the building; existing structures would require demolition and reconstruction to access the affected soil. For Alternative 3B, off-site disposal would complete the action. Alternative 3C would require construction of a soil pile with SVE pipes, and a treatment system to treat the extracted vapor. A portion of existing property would be required for the soil pile.

Alternative 3D would require installation of SVE wells and a treatment system to treat extracted soil vapor. Existing structures would not affect installation or operation of the system. Operational requirements and length of time to achieve the cleanup standard would be greater for Alternative 3D than for Alternatives 3B or 3C.

Cost

The total costs for Alternatives 3B, 3C, and 3D are as follows:

Location	Alternative 3B	Alternative 3C	Alternative 3D
Building 658	\$260,000	\$460,000	\$435,000
Building 763	\$4,220,000	\$2,220,000	\$620,000

For Building 658, the cost of Alternative 3B would primarily result from transportation and disposal of untreated soil. For Alternatives 3C and 3D, the cost would primarily be due to construction and operation of the SVE treatment systems. For small volumes of unobstructed soil, excavation and off-site disposal would cost the least to implement (Alternative 3B).

Alternative 3D is the least costly of the three alternatives for Building 763 because implementability of in situ treatment would not require demolition and reconstruction of existing structures (a major cost factor). For large volumes of obstructed soil, in situ treatment would cost the least to implement (Alternative 3D).

MODIFYING CRITERIA

Community Acceptance

The PP was presented to the community (in English and Spanish) and discussed at a public meeting. The community stated no objection to the AF's preferred remedy for shallow subsurface soils with TCE only: Alternative 3C at Building 658 and Alternative 3D at Building 763.

State Acceptance

The State of California has reviewed the CBA OU FS and the PP. The State stated no objection to the AF's preferred remedy for shallow subsurface soils with TCE only: Alternative 3C at Building 658 and Alternative 3D at Building 763.

8.2.3 SHALLOW SUBSURFACE SOIL (TCE AND CHROMIUM)

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment

Alternatives 4B and 4C would be protective of human health and the environment. The risk to human health from exposure (dermal contact and ingestion) to soil containing chromium is reduced to less than unity. The risk to the environment from groundwater degradation by TCE in soil is reduced. Alternative 4A is not protective of the environment because it does not reduce the risk to below unity. There is a potential future risk to human health from TCE in soil.

Compliance with ARARS

Alternatives 4B and 4C would comply with chemical-specific, location-specific, and action-specific ARARs. Alternative-specific ARAR compliance is discussed in Sect. 7.0 and presented in Table 7-2.

See also discussion of Chapter 15 under Section 8.2.2.

PRIMARY BALANCING CRITERIA

Long-Term Effectiveness and Permanence

Alternatives 4B and 4C would mitigate any potential future risk by preventing dermal contact and ingestion of soil containing chromium, and migration of TCE in shallow subsurface soils to the groundwater. No risk to human health or groundwater would remain from the residual chromium or TCE, respectively, remaining at the site; management and controls would not be required. Alternatives 4B and 4C would both provide a high degree of long-term effectiveness and permanence by permanently removing TCE and chromium above cleanup standards from the site through excavation. Alternative 4B would provide effectiveness and permanence for TCE and chromium if soil is treated at the Subtitle C disposal facility. Alternative 4C would provide effectiveness and permanence for TCE by using SVE to remove TCE above the cleanup standard from excavated soil; effectiveness and permanence for chromium would be provided if soil is treated at the Subtitle C disposal facility, similar to Alternative 4B. Off-site disposal of untreated waste is not a preferred option if other treatment options can feasibly be implemented onsite. On-site treatment, however, is not practical to implement due to the small volume of soil containing chromium and TCE.

Reduction of Toxicity, Mobility or Volume Through Treatment

Alternatives 4B and 4C would reduce contaminants at the site. Alternative 4C would reduce the toxicity, mobility, and volume of TCE in shallow soil by removing the TCE vapor. Soil vapor treated to comply with air quality ARARs will result in permanent reduction of the toxicity, mobility, and volume of TCE. Permanent reduction in toxicity, mobility, and volume of the chromium in soil would only result if treatment is performed at the Subtitle C disposal facility. Alternative 4B would reduce the toxicity, mobility, and volume of shallow soils containing TCE and chromium at the site, but would only result in permanent reduction in toxicity, mobility, and volume of the TCE and chromium if treatment is performed at the Subtitle C disposal facility.

Short-Term Effectiveness

Alternatives 4B and 4C both provide short-term effectiveness. Risk associated with excavation, SVE, treatment, discharge, and disposal are mitigated by the health and safety plan for the site. Alternative 4B would provide greater short-term effectiveness because excavation and off-site disposal immediately removes the contaminated material from the site. Alternative 4C would provide a lesser degree of short-term effectiveness of the two because the excavated soil must be handled and treated onsite.

Alternative 4B would require 6 months to achieve cleanup standards. Alternative 4C would require 9 months to achieve cleanup standards.

Implementability

Alternative 4B would be the most practical to implement. Existing structures would require demolition and reconstruction to access the affected soil, but off-site disposal would complete the action. Alternative 4C would require the demolition and reconstruction under Alternative 4B, as well as construction of a soil pile with SVE pipes and a treatment system to treat the extracted vapor. A portion of existing property would be required for the soil pile.

Cost

The total cost would be \$1,220,000 for Alternative 4B and \$1,529,000 for Alternative 4C. Construction and operation of the on-site ex situ SVE system to treat the TCE in soil accounts for the increased cost of Alternative 4C.

MODIFYING CRITERIA

Community Acceptance

The PP was presented to the community (in English and Spanish) and discussed at a public meeting. The San Bernardino International Airport Authority agreed that the cleanup standard for chromium is protective of human health based upon ingestion, and concurred with the AF's choice of a composite cleanup method for TCE- and chromium-contaminated soil. In general, the community stated no objection to the AF's preferred remedy (Alternative 4B) for shallow subsurface soil with TCE and chromium.

State Acceptance

The State of California has reviewed the CBA OU FS and the PP. The State stated no objection to the AF's preferred remedy (Alternative 4B) for shallow subsurface soil with TCE and chromium.

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9.0 SELECTED REMEDY

Modification to the selected remedy as a result of RD and construction processes will be necessary. Detailed design specifications, and performance evaluations and schedule will be determined during the RD.

The selected groundwater and soil remedies will meet the cleanup standards presented below in Table 9-1. After the selected soil remedies have been completed, soil samples will be taken and analyzed to ensure that the cleanup standards have been achieved. For chromium, remaining soil must not exceed 150 ppm. For TCE, remaining soil must not exceed 5 ppb ($\mu\text{g/L}$) leachate concentration determined by TCLP.

Table 9-1
CBA OU CLEANUP STANDARDS

MEDIA	COMPOUND	CLEANUP STANDARD	CLEANUP STANDARD SOURCE
<i>Groundwater</i>	Benzene	1 $\mu\text{g/L}$	State of California Maximum Contaminant Level
	1,2-Dichloroethane	0.5 $\mu\text{g/L}$	State of California Maximum Contaminant Level
	1,2-Dichloroethylene (total)	6 $\mu\text{g/L}$	State of California Maximum Contaminant Level
	Tetrachloroethylene	5 $\mu\text{g/L}$	USEPA Maximum Contaminant Level
	1,1,1-Trichloroethane	200 $\mu\text{g/L}$	USEPA Maximum Contaminant Level
	TCE	5 $\mu\text{g/L}$	USEPA Maximum Contaminant Level
	Vinyl Chloride	0.5 $\mu\text{g/L}$	State of California Maximum Contaminant Level
<i>Soil</i>	TCE	5 $\mu\text{g/L}$ leachate concentration	Derived by Toxicity Characteristics Leaching Procedure (TCLP)
	Chromium	150 mg/kg	State of California Potency Factor
<i>Indoor Air</i>	Vinyl Chloride	0.2 ppmv	USEPA/SCAQMD Action Level

The groundwater cleanup standards are based on the USEPA or State of California MCLs for drinking water, whichever is more stringent. There are no ARARs that establish cleanup levels for contaminated soil. For TCE in soil, the primary concern is protection of groundwater quality; a 5 $\mu\text{g/L}$ leachate concentration has been assigned as the cleanup standard for TCE. For chromium in soil, the primary concern is exposure due to ingestion or dermal contact; a cleanup standard of 150

mg/kg has been assigned to chromium based on the State of California Potency Factor.¹ The chromium cleanup standard is within the USEPA acceptable risk range of 10^{-4} to 10^{-6} . An indoor air cleanup standard for vinyl chloride, a risk-based USEPA action level, has been developed in the event that vinyl chloride is detected in soil vapor, due to its presence in groundwater, during SVE activities.

9.1 GROUNDWATER

The selected remedy is Alternative 1B:

- Deed restrictions
- Groundwater monitoring
- Groundwater extraction
- Wellhead treatment or provision of water supplies
- Treatment by air stripping
- Direct discharge of emissions to atmosphere, or treatment by vapor-phase carbon adsorption if emissions are not in compliance with air quality ARARs
- Reinjection of treated water.

Deed restrictions will be placed on any Norton AFB property that overlies the VOC plume prior to sale or transfer to prohibit the installation of water wells in areas that still contain VOCs above cleanup standards.

Selected monitoring wells will be sampled on a quarterly basis for VOCs only to monitor the groundwater conditions occurring beneath and beyond the base boundary. Existing sampling equipment will be utilized and replaced as needed.

Extraction well placement and design will be determined during the RD phase following plume characterization. Specific design parameters to implement the remedy will also be determined during the RD phase.

For off-base water supply wells where contaminant levels exceed the MCLs, the AF will provide water treatment facilities using mobile GAC treatment units or alternate water supplies. As appropriate, the AF will also provide long-term treatment such as permanent installation of an air stripping system, replacement wells or other actions. These actions will be implemented in accordance with the decision matrix outlined in the Norton AFB Off-Base Water Supply Contingency Policy, dated August 25, 1993. ARARs identified for carbon adsorption (Alternative 1C) will be ARARs for this portion of Alternative 1B, and will be complied with.

The selected end-use option for treated groundwater is reinjection. Injection well placement and design will be determined during the RD phase.

The selected remedy would have an estimated cost of \$28,050,000 based on the period of performance of 30 years. Table 9-2 presents the estimated total cost, including cost of capital, O&M, and present worth.

¹ Refer to Sect. 2.3.3 of the Final CBA OU FS for a discussion of the development of the chromium cleanup standard.

TABLE 9-2
COST SUMMARY FOR
GROUNDWATER ALTERNATIVE

DIRECT/INDIRECT CAPITAL COSTS		Extraction/Air Stripping	
<hr/>			
CONSTRUCTION COSTS			
Extraction System		\$938,000	
Air Stripping Package Systems		\$903,589	
EQUIPMENT COSTS		\$960,860	
LAND AND SITE DEVELOPMENT		\$355,937	
BUILDING AND SERVICES		\$90,000	
RELOCATION COSTS		\$0	
DISPOSAL COSTS		\$465,850	
[Capital Costs Subtotal, Rounded]		\$3,714,000	
CONTRACTOR'S COSTS	25% of subtotal	\$929,000	
> TOTAL DIRECT CAPITAL COSTS		\$4,643,000	
ENGINEERING AND DESIGN	15% of direct capital	\$696,000	
CONTINGENCY ALLOWANCE	25% of direct capital	\$1,161,000	
OTHER INDIRECT COSTS	15% of direct capital	\$696,000	
> TOTAL INDIRECT CAPITAL COSTS		\$2,553,000	
>> TOTAL CAPITAL COSTS (Direct + Indirect, Rounded)		\$7,200,000	
<hr/>			
ANNUAL/PERIODIC COSTS -- life of 30 years		ANNUAL COSTS	PRESENT WORTH 7% Discount Rate
LABOR (Based on 24 hr/day, 360 day/yr operation)		\$96,100	\$1,193,000
MAINTENANCE MATERIALS		\$274,600	\$3,408,000
AUXILIARY MATERIALS & LABOR/POWER		\$285,900	\$3,547,000
PURCHASED SERVICES		\$105,800	\$1,313,000
> TOTAL DIRECT ANNUAL COSTS (Rounded):		\$762,000	\$9,461,000
OTHER COSTS (PERIODIC COSTS)		\$1,961,000	\$1,261,330
Contractor's Overhead & Profit	25% of other costs	\$490,000	\$490,000
> TOTAL DIRECT PERIODIC COSTS (Rounded):		\$2,451,000	\$1,751,000
INDIRECT ANNUAL COSTS	45% of annual	\$343,000	\$4,256,000
INDIRECT PERIODIC COSTS	46% of periodic	\$1,129,000	\$1,129,000
>> TOTAL ANNUAL COSTS (Direct + Indirect)		\$1,105,000	
>> TOTAL ANNUAL/PERIODIC PRESENT WORTH COSTS			\$16,600,000
<hr/>			
COST SUMMARY FOR THIS REMEDY			
>> TOTAL CAPITAL COSTS (Direct + Indirect)		\$7,200,000	
>> TOTAL PRESENT WORTH COSTS (Direct + Indirect)			\$16,600,000
REINJECTION COSTS			\$4,250,000
EMISSION CONTROLS		(without emission controls)	\$28,050,000
>>> GRAND TOTAL (CAPITAL + PRESENT WORTH OF THE ANNUAL/PERIODIC COSTS):		(with emission controls)	\$37,560,000

- All costs Based on January 1992, using an ENR CCI of 4885

If emission levels from the air stripper are in compliance with air quality ARARs, emissions will be directly discharged. Direct discharge of emission levels would be protective of human health and the environment in an ozone non-attainment area (estimated carcinogenic risk of 1.5×10^{-6}). If emission levels are no longer protective of human health and the environment, the remedy will be upgraded with ARARs, vapor-phase carbon adsorption, which will be built into the design of the air stripper. The air stripper will be used to ensure protectiveness and meet air quality ARARs. The estimated cost for the air stripper and vapor-phase carbon over the 30-year treatment period would increase the total estimated cost to an estimated \$37,560,000.

The off-base groundwater remedy will be consistent with this ROD.

9.2 SOIL

Should it be determined that SVE will not meet treatment standards, another action will be considered as a contingency remedy. Implementation of a contingency remedy will be documented in an amendment to this ROD.

9.2.1 DEEP SUBSURFACE SOIL

The selected remedy is Alternative 2C for the MW90 area and Alternative 2D for the MW91 area.

- Deed restrictions
- Groundwater monitoring
- Treatment by in situ SVE
- Treatment of emissions by vapor-phase carbon adsorption, or no action, if emissions are in compliance with air quality ARARs.

Deed restrictions will be placed on any Norton AFB property that currently or previously had soil contamination prior to sale or transfer to prohibit excavation in the future until the cleanup standard is attained.

Existing monitoring wells at and downgradient from the affected soil will be installed to monitor the upper aquifer and perched zone groundwater quarterly for TCE.

SVE design and operational parameters will be determined during the feasibility study and treatability testing. SVE wells will be installed to the depth of soil contamination to meet the cleanup standard. Soil vapor containing TCE will be removed using a blower. The soil vapor will be separated from the air and the separated water will be transported to the selected groundwater remedy. If the SVE system is proven to be not capable of achieving the cleanup level, then the Air Quality Management Plan (AQMP) contingency remedy, such as perched zone dewatering, in order to achieve the cleanup level.

The SVE system will include vapor-phase carbon that will be employed to remove soil vapor that contains TCE at levels that are not protective of human health and the environment and to comply with ARARs. The estimated capital cost for a representative SVE system is \$80,000, and O&M for continual maintenance in the form of carbon changeout service provided by the vendor is \$59,000 per year.

During SVE treatment, soil vapor will be monitored for vinyl chloride that may be present due to its presence in groundwater. If detected above the indoor air cleanup standard, soil vapor will be

vicinity will be monitored for vinyl chloride. Buildings with indoor concentrations above the cleanup standard will be fitted with ventilation systems.

It is estimated that it will take 18 months to achieve the deep subsurface soil cleanup standard at the MW90 Area and Building 763 at a total cost of \$2,708,000. Table 9-3 presents the estimated total cost for SVE, including cost of capital, O&M, and present worth for each deep subsurface source area, and treatability study costs. Vapor treatment costs are included based on carbon system costs outlined above.

9.2.2 SHALLOW SUBSURFACE SOILS (TCE ONLY)

BUILDING 658

The selected remedy is Alternative 3C:

- Excavation of soil containing TCE above the cleanup standard
- Backfill of excavation with clean import or borrow soil
- Transportation onsite to treatment location
- Treatment by ex situ SVE
- Treatment of emissions by vapor-phase carbon adsorption, or no treatment if emissions are in compliance with air quality ARARs
- On-base use of treated soil.

An estimated 490 cy of soil containing TCE above the cleanup standard will be excavated. SVE design and operational parameters will be determined during the RD phase. Excavated soil will be transported to a pre-determined location onsite. A soil pile will be constructed with prepacked and constructed extraction pipes. The pile will be covered and underlain by an impermeable liner to prevent uncontrolled volatilization of TCE during and when treatment is not in process.

Soil vapor containing TCE will be removed using a blower or vacuum pump. Any separated water will be transported to the selected groundwater remedy for treatment. The SVE system will include vapor-phase carbon that will be employed if soil vapor contains TCE at levels that are not protective of human health and the environment or do not comply with ARARs. Treated soil will be

used onbase (e.g., for construction or landscaping purposes).

It is estimated that it will take 6 months to achieve the shallow subsurface soil cleanup standard for TCE only at a cost of \$570,000. Table 9-4 presents the estimated total cost, including capital and O&M. Vapor treatment costs are included based on costs for a representative emission treatment system; refer to Sect. 9.2.1.

BUILDING 763

The selected remedy is Alternative 3D:

- Deed restrictions
- Groundwater monitoring
- Treatment by in situ SVE
- Treatment of emissions by vapor-phase carbon adsorption, or no treatment if emissions are in compliance with air quality ARARs.

The remedy is the same as that selected for deep subsurface soil at this location.

It is estimated that it will take 1 year to achieve the shallow subsurface soil cleanup standard for TCE at a cost of \$759,000. Table 9-4 presents the estimated total cost, including cost of capital and O&M. Vapor treatment costs are included based on costs for a representative emission treatment system; refer to Sect. 9.2.1.

TABLE 9-3
COST SUMMARY FOR
DEEP SUBSURFACE SOIL ALTERNATIVES

DIRECT/INDIRECT CAPITAL COSTS		MW90 Area In Situ SVE	Building 763 In Situ SVE
CONSTRUCTION COSTS		\$17,800	\$39,163
EQUIPMENT COSTS		\$94,839	\$50,039
LAND AND SITE DEVELOPMENT		\$57,729	\$57,729
BUILDING AND SERVICES		\$15,400	\$15,400
RELOCATION COSTS		\$0	\$0
DISPOSAL COSTS		\$1,200	\$400
[Capital Costs Subtotal, Rounded]		\$187,000	\$163,000
CONTRACTOR'S COSTS	25% of subtotal	\$46,000	\$40,000
> TOTAL DIRECT CAPITAL COSTS		\$233,000	\$203,000
ENGINEERING AND DESIGN	15% of direct capital	\$35,000	\$30,000
CONTINGENCY ALLOWANCE	25% of direct capital	\$58,000	\$51,000
OTHER INDIRECT COSTS	15% of direct capital	\$34,000	\$30,000
> TOTAL INDIRECT CAPITAL COSTS		\$127,000	\$111,000
>> TOTAL CAPITAL COSTS (Direct + Indirect, Rounded)		\$360,000	\$310,000

ANNUAL/PERIODIC COSTS – life of 1.5 years		ANNUAL COSTS	PRESENT WORTH 7% Discount Rate	ANNUAL COSTS	PRESENT WORTH 7% Discount Rate
LABOR (Based on 24 hr/day, 360 day/yr operation)		\$26,000	\$36,000	\$26,000	\$36,000
MAINTENANCE MATERIALS		\$7,000	\$9,000	\$7,000	\$9,000
AUXILIARY MATERIALS & LABOR/POWER		\$49,300	\$67,700	\$49,300	\$67,700
PURCHASED SERVICES		\$317,000	\$428,000	\$317,000	\$428,000
> TOTAL DIRECT ANNUAL COSTS (Rounded):		\$399,000	\$540,000	\$399,000	\$540,000
OTHER COSTS (PERIODIC COSTS)		\$37,000	\$36,600	\$37,000	\$36,600
Contractor's Overhead & Profit	25% of other costs	\$9,000	\$9,000	\$9,000	\$9,000
> TOTAL DIRECT PERIODIC COSTS (Rounded):		\$46,000	\$46,000	\$46,000	\$46,000
INDIRECT ANNUAL COSTS	45% of annual	\$180,000	\$249,000	\$180,000	\$221,000
INDIRECT PERIODIC COSTS	46% of periodic	\$21,000	\$21,000	\$21,000	\$21,000
>> TOTAL ANNUAL COSTS (Direct + Indirect)		\$579,000		\$579,000	
>> TOTAL ANNUAL/PERIODIC PRESENT WORTH COSTS			\$860,000		\$830,000

COST SUMMARY FOR THIS REMEDY			
>> TOTAL CAPITAL COSTS (Direct + Indirect)		\$360,000	\$310,000
>> TOTAL PRESENT WORTH COSTS (Direct + Indirect)		\$860,000	\$830,000
>>> TOTAL (CAPITAL + PRESENT WORTH OF THE ANNUAL/PERIODIC COSTS):		\$1,220,000	\$1,140,000
>>> TREATABILITY STUDY COST:		\$5,000	\$5,000
		(without emission controls)	\$1,225,000
EMISSION CONTROLS		\$169,000	\$169,000
>>>> GRAND TOTAL:		(with emission controls)	\$1,394,000

TABLE 9-4
COST SUMMARY FOR
SHALLOW SUBSURFACE SOILS (TCE ONLY) ALTERNATIVES

DIRECT/INDIRECT CAPITAL COSTS		Building 658 Excavation/Ex Situ SVE	Building 763 In Situ SVE
CONSTRUCTION COSTS		\$29,213	\$12,727
EQUIPMENT COSTS		\$24,579	\$16,060
LAND AND SITE DEVELOPMENT		\$34,829	\$11,800
BUILDING AND SERVICES		\$13,750	\$12,000
RELOCATION COSTS		\$0	\$0
DISPOSAL COSTS		\$0	\$240
[Capital Costs Subtotal, Rounded]		\$102,400	\$53,000
CONTRACTOR'S COSTS	25% of subtotal	\$25,000	\$14,000
> TOTAL DIRECT CAPITAL COSTS		\$127,400	\$67,000
ENGINEERING AND DESIGN	15% of direct capital	\$19,000	\$10,000
CONTINGENCY ALLOWANCE	25% of direct capital	\$32,000	\$17,000
OTHER INDIRECT COSTS	15% of direct capital	\$19,000	\$11,000
> TOTAL INDIRECT CAPITAL COSTS		\$70,000	\$38,000
>> TOTAL CAPITAL COSTS (Direct + Indirect, Rounded)		\$197,000	\$110,000
OPERATION & MAINTENANCE COSTS		ANNUAL COSTS 6 month life	ANNUAL COSTS 1 year life
LABOR (Based on 24 hr/day, 360 day/yr operation)		\$7,600	\$13,100
MAINTENANCE MATERIALS		\$3,100	\$5,500
AUXILIARY MATERIALS & LABOR/POWER		\$10,400	\$4,000
PURCHASED SERVICES		\$164,500	\$295,300
OTHER COSTS (PERIODIC COSTS)		\$7,000	\$24,000
Contractor's Overhead & Profit	25% of other costs	\$2,000	\$6,000
> TOTAL DIRECT PERIODIC COSTS (Rounded):		\$195,000	\$348,000
INDIRECT O&M COSTS	45% of periodic	\$88,000	\$157,000
>> TOTAL O&M COSTS (Direct + Indirect)		\$263,000	\$505,000
COST SUMMARY FOR THIS REMEDY			
>> TOTAL CAPITAL COSTS (Direct + Indirect)		\$197,000	\$110,000
>> TOTAL O&M COSTS (Direct + Indirect)		\$263,000	\$505,000
	(without emission controls)	\$460,000	\$615,000
EMISSION CONTROLS		\$110,000	\$139,000
TREATABILITY STUDY COST		\$0	\$5,000
>>> GRAND TOTAL (CAPITAL + O&M COSTS):	(with emission controls)	\$570,000	\$759,000

- All costs Based on January 1992, using an ENR CCI of 4885

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9.2.3 SHALLOW SUBSURFACE SOIL (TCE AND CHROMIUM)

The selected remedy is Alternative 4B:

- Demolition and reconstruction of existing facilities
- Excavation of soil containing TCE and chromium commingled above the cleanup standards
- Backfill of excavation with clean import or borrow soil
- Testing of excavated soil
- Transportation of soil offsite by licensed transporter
- Disposal offsite to a licensed Subtitle C disposal facility.

Demolition and reconstruction of the electroplating shop and adjacent office will be necessary to excavate an estimated 415 cy of soil containing TCE and chromium above cleanup standards. Soil will be tested to determine levels of TCE and chromium. The remedy will occur concurrent with the selected remedy for shallow subsurface soil with TCE only. The excavation will be backfilled immediately with clean import or borrow soil. Reconstruction will occur as soon as possible.

Excavated soil containing TCE and chromium above cleanup standards will be immediately loaded onto trucks licensed for the transport of contaminated soils. Soil will be tested to determine whether it is a RCRA hazardous waste. Soil will be transported to a licensed Subtitle C disposal facility that will treat the soil if concentrations exceed disposal standards. The AF has identified various options for disposal of contaminated soil; these Subtitle C disposal facilities will be presented during the RD phase.

It is estimated that it will take 6 months to achieve the cleanup standards for shallow subsurface soil with TCE and chromium commingled at a cost of \$1,220,000. Table 9-5 presents the estimated total cost.

TABLE 9-5
COST SUMMARY FOR
SHALLOW SUBSURFACE SOILS (TCE AND CHROMIUM) ALTERNATIVE

DIRECT/INDIRECT CAPITAL COSTS		IRP Site 9 Excavation/Off-Site Disposal
CONSTRUCTION COSTS		\$99,200
EQUIPMENT COSTS		\$1,868
LAND AND SITE DEVELOPMENT		\$359,850
BUILDING AND SERVICES		\$1,750
RELOCATION COSTS		\$0
DISPOSAL COSTS		\$166,680
[Capital Costs Subtotal, Rounded]		\$629,000
CONTRACTOR'S COSTS	25% of subtotal	\$156,000
> TOTAL DIRECT CAPITAL COSTS		\$785,000
ENGINEERING AND DESIGN	15% of direct capital	\$118,000
CONTINGENCY ALLOWANCE	25% of direct capital	\$196,000
OTHER INDIRECT COSTS	15% of direct capital	\$118,000
> TOTAL INDIRECT CAPITAL COSTS		\$432,000
>> TOTAL CAPITAL COSTS (Direct + Indirect, Rounded)		\$1,220,000
=====		
COST SUMMARY FOR THIS REMEDY		
>> TOTAL CAPITAL COSTS (Direct + Indirect)		\$1,220,000
>> TOTAL PRESENT WORTH COSTS		\$0
>>> GRAND TOTAL (CAPITAL + PRESENT WORTH):		\$1,220,000
=====		

- All costs Based on January 1992, using an ENR CCI of 4885

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10.0 STATUTORY DETERMINATIONS

This section discusses how the selected remedies meet the following statutory requirements:

- Protect human health and the environment and meet several other statutory requirements of CERCLA Section 121, and when completed, comply with ARARs unless a statutory waiver is justified.
- Are cost-effective and utilize permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable.
- Involve treatment to permanently and significantly reduce the toxicity, mobility, or volume of hazardous wastes as their principal element.

10.1 GROUNDWATER

Section 8.1 provides a comparative analysis of groundwater treatment alternatives based on Section 121 CERCLA evaluation criteria.

Protection of Human Health and the Environment

The selected remedy protects human health and the environment by extracting the contaminated groundwater and treating it through air stripping. Air stripping will remove VOCs from groundwater and reduce the current potential risks to human health from ingestion and inhalation of airborne vapors from 7.1×10^{-5} to a level no greater than 10^{-6} (within the acceptable exposure range of 10^{-4} to 10^{-6}). The selected remedy will also reduce the risk to the environment from groundwater degradation. There are no short-term threats associated with this remedy that cannot be readily controlled. No adverse cross-media impacts are expected from this remedy. Risk from direct discharge of air stripping tower emissions will be no greater than 10^{-6} (estimated to be 1.6×10^{-7}), and will be treated with vapor-phase activated carbon if direct discharge exceeds air quality ARARs; adsorbed TCE would be destroyed through carbon regeneration.¹

Compliance with ARARs

The selected remedy will comply with all chemical-, location-, and action-specific ARARs; no ARAR waivers are required (refer to Table 7-1).

Cost Effectiveness

The selected remedy is cost-effective because it has been determined to provide overall effectiveness proportional to its cost. The total estimated net present worth cost for air stripping (direct discharge) over a 30-year period is \$28,050,000, which is 78% less than the net present worth cost of the Carbon Adsorption alternative. If vapor-phase activated carbon adsorption treatment is employed to comply with air quality ARARs, the present worth cost would increase to \$37,560,000, which is 72% less than the Carbon Adsorption alternative.

¹ The carbon is supplied as a service from a carbon vendor. The vendor determines whether the carbon will be regenerated.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

The selected remedy represents the maximum extent practicable to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the CBA OU. Air stripping provides the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, and volume through treatment, short-term effectiveness, implementability, and cost.

The two alternatives are reasonably comparable with respect to short-term effectiveness, but differ in reduction in toxicity, mobility, and volume through treatment. Air stripping will meet the cleanup standards, but will not permanently reduce the toxicity, mobility, and volume of VOCs released into the atmosphere unless they are treated. The Carbon Adsorption alternative will permanently reduce the toxicity, mobility, and volume of VOCs if the spent carbon is regenerated. The major tradeoffs that provide the basis for this selection decision, however, are long-term effectiveness, implementability, and cost. The selected remedy provides 1) greater long-term effectiveness and permanence because there is no residual risk, 2) has greater implementability because it can utilize the existing groundwater treatment system, and 3) achieves this at significantly lower present worth costs.

The selected remedy has been accepted by USEPA and the State; no objection has been made by the community.

Preference for Treatment as a Principal Element

The selected remedy satisfies the statutory preference for remedies that employ treatment as a principal element. By treating the VOC-contaminated groundwater through an air stripping tower, the selected remedy addresses the principal threat posed by the CBA OU through the use of a proven treatment technology.

10.2 SOILS

Section 8.2 provides a comparative analysis of soil alternatives based on Section 121 CERCLA evaluation criteria.

10.2.1 DEEP SUBSURFACE SOILS

Protection of Human Health and the Environment

The selected remedy is protective of human health and the environment through the removal of TCE from soils by in situ SVE. The current levels of TCE in soil are present at acceptable levels to human health (risk is less than 10^{-6}), but pose a threat to groundwater resources. In situ SVE eliminates the threat to groundwater by removing the TCE in soil. There are no short-term threats associated with construction or implementation of this remedy that cannot be readily controlled. The only cross-media impacts from this remedy would be spent carbon used to treat SVE emissions to meet air quality ARARs. However, adsorbed TCE would be destroyed if carbon is regenerated.

Compliance with ARARs

The selected remedy will comply with all chemical-, location-, and action-specific ARARs; no ARAR waivers are required (refer to Table 7-2).

Cost Effectiveness

Although the selected remedy costs more than the dewatering alternative, it is considered cost-effective because it provides more overall effectiveness proportional to its cost. The total estimated net present worth cost is \$2,708,000, which is approximately 56% more than the Groundwater Monitoring/Perched Zone Dewatering alternative, but should remove more TCE directly from the source and in significantly less time.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

The selected remedy represents the maximum extent practicable to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for deep subsurface source removal. In situ SVE provides the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, and volume through treatment, short-term effectiveness, implementability, and cost.

The two alternatives are reasonably comparable with respect to implementability, but differ in cost (\$2,708,000 for the selected alternative and \$1,740,000 for the Groundwater Monitoring/Perched Zone Dewatering alternative). The major tradeoffs that provide the basis for this selection decision, however, are long-term effectiveness, reduction of toxicity, mobility, and volume, and short-term effectiveness. The selected remedy provides a greater degree of long-term effectiveness and permanence because 1) it should remove more TCE from the soil than the dewatering alternative, resulting in a greater reduction of toxicity, mobility, and volume of TCE in soil (permanent reduction is achieved if spent carbon, used to treat emissions to comply with air quality ARARs, is regenerated); and 2) provides a higher degree of short-term effectiveness by accomplishing cleanup in 18 months rather than 30 years. The treatment advantages support the additional cost requirements.

The selected remedy has been accepted by USEPA and the State; no objection has been made by the community.

Preference for Treatment as a Principal Element

The selected remedy satisfies the statutory preference for remedies that employ treatment as a principal element. By removing TCE in deep subsurface soils and treating the extracted vapor to meet air quality ARARs, the selected remedy addresses one of the principal threats posed by the CBA OU source areas through the use of treatment technologies.

10.2.2 SHALLOW SUBSURFACE SOILS (TCE ONLY)

Two different remedies have been selected for shallow subsurface soil containing TCE only. At Building 658, excavation and ex situ SVE with on-base use of treated soil (e.g., for landscaping or construction purposes) is the selected remedy. At Building 763, in situ SVE is the selected remedy.

Protection of Human Health and the Environment

The selected remedies are protective of human health and the environment through removal of TCE. The current levels of TCE in soil do not pose a risk to human health (risk is less than 10^{-6} for ingestion and dermal contact), but do pose a threat to groundwater resources. There are no short-term threats associated with construction or implementation of these remedies that cannot be

readily controlled. The only cross-media impacts from the remedies would be spent carbon used to treat SVE emissions if they exceed air quality ARARs. However, adsorbed TCE would be destroyed if carbon is regenerated.

Building 658

TCE is removed from soil by excavation, and treated by ex situ SVE. Excavation eliminates the threat to groundwater by removing the soil containing TCE. The acceptable risk to human health is even further reduced by SVE treatment.

Building 763

TCE is removed from soil by in situ SVE, eliminating the threat to groundwater and further reducing the acceptable risk to human health.

Compliance with ARARs

The selected remedies will comply with all chemical-, location-, and action-specific ARARs; no ARAR waivers are required (refer to Table 7-2).

Cost Effectiveness

The selected remedies are cost-effective because each has been determined to provide overall effectiveness proportional to its cost.

Building 658

The total estimated net present worth cost is \$570,000, which is less than the In Situ SVE alternative but more than the Excavation and Off-site Disposal alternative; In Situ SVE is 1% more than the selected remedy while Excavation and Off-site Disposal is 45% of the selected remedy. The selected remedy costs more than the Excavation and Off-site Disposal alternative, but it employs treatment as a principal element and no residuals would remain due to complete source removal. Compared to the In Situ SVE alternative, the selected remedy can be accomplished in less time and at a lower cost.

Building 763

The total estimated net present worth cost is \$759,000, which is 67% less than the Excavation/Ex Situ SVE/On-base Use alternative and 82% less than the Excavation and Off-site Disposal alternative.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

The selected remedies represent the maximum extent practicable to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for source removal of shallow subsurface soils containing TCE only. The selected remedies provide the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, and volume through treatment, short-term effectiveness, implementability, and cost.

Building 658

The three alternatives are reasonably comparable with respect to long-term effectiveness and reduction in toxicity, mobility, and volume; the selected remedy has a greater cost than Excavation and Off-site Disposal and a lower cost than In Situ SVE (see costs above). The major tradeoffs that provide the basis for this selection decision are short-term effectiveness and implementability. The selected remedy provides less short-term effectiveness than the Excavation and Off-site Disposal alternative because soil is treated onsite, but greater short-term effectiveness than the In Situ SVE alternative because contaminated soil is immediately removed from the site. The selected remedy can be implemented in 6 months, equivalent to off-site disposal and less than that required for in situ SVE. For the small volume of affected soil, the selected remedy provides the most short-term effectiveness and is the most implementable for the cost.

Building 763

The three alternatives are reasonably comparable with respect to long-term effectiveness, reduction in toxicity, mobility, and volume, and short-term effectiveness. The major tradeoffs that provide the basis for this selection decision are implementability and cost. The selected remedy is the easiest to implement of the three alternatives. The Excavation/Ex Situ SVE/On-base Use and Excavation and Off-site Disposal alternatives require demolition and reconstruction of active facilities inside Building 763, which is currently used for maintenance operations by both Norton AFB and Lockheed, to access contaminated soil. After base closure, Lockheed will continue its operations in the facility. Excavation would disrupt shop activities; shop work would have to be relocated or suspended. The cost of the selected alternative is three times less than the other alternatives due to the added costs for demolition and reconstruction. The selected remedy can be quickly implemented, does not require shop demolition or suspension of shop activities, and costs less.

The selected remedies have been accepted by USEPA and the State; no objection has been made by the community.

Preference for Treatment as a Principal Element

The selected remedies satisfy the statutory preference for remedies that employ treatment as a principal element.

Building 658

By excavating shallow subsurface soil containing TCE, and removing and treating the extracted vapor to meet air quality ARARs, the selected remedy addresses one of the principal threats posed by the CBA OU source areas through the use of treatment technologies.

Building 763

By removing TCE in shallow subsurface soil and treating the extracted vapor to meet air quality ARARs, the selected remedy addresses one of the principal threats posed by the CBA OU source areas through the use of treatment technologies.

10.2.3 SHALLOW SUBSURFACE SOIL (TCE AND CHROMIUM)

Protection of Human Health and the Environment

The selected remedy protects human health and the environment through excavation and off-site disposal at a licensed facility. The source of chromium, a threat to human health, commingled with TCE, a threat to groundwater, is removed from the site. Source removal eliminates possible human ingestion and dermal contact, and possible impacts to groundwater. The current carcinogenic and noncarcinogenic risk to human health from ingestion and dermal contact of soil containing chromium (carcinogenic risk of 3.7×10^{-3} [Cal-EPA slope factor] and Hazard Index of 19.3, respectively) is reduced to the USEPA acceptable 10^{-4} to 10^{-6} range and a Hazard Index of less than 1, respectively. The current levels of TCE in soil are present at acceptable risk from direct contact exposure levels (less than 10^{-6}), but the selected remedy will eliminate the threat to groundwater resources. There are no short-term threats associated with construction or implementation of this remedy that cannot be readily controlled. No adverse cross-media impacts are expected at the site from this remedy.

Compliance with ARARs

The selected remedy will comply with all chemical-, location-, and action-specific ARARs and TBCs; no ARAR waivers are required (refer to Table 7-2).

Cost Effectiveness

The selected remedy is cost-effective because it has been determined to provide overall effectiveness proportional to its cost. The total estimated net present worth cost is \$1,220,000, 26% less than the Excavation/Ex Situ SVE/Off-site Disposal alternative.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

The selected remedy represents the maximum extent practicable to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for source removal of shallow subsurface soil contaminated with chromium commingled with TCE. The selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, and volume through treatment, short-term effectiveness, implementability, and cost.

The two alternatives are reasonably comparable with respect to long-term effectiveness, and reducing toxicity, mobility, and volume of contaminants. Both the selected remedy and the Ex Situ alternative remove TCE from the site and protect groundwater, but chromium remains a concern due to its risk to human health and must be addressed (the Ex Situ alternative removes TCE from soil but chromium is still present). The selected remedy and the Ex Situ alternative dispose of the soil at an off-site Subtitle C disposal facility; a reduction in the toxicity, mobility, and volume of chromium in soil would depend on the treatment performed at the receiving facility. Therefore, the major tradeoffs that provide the basis for this selection decision are short-term effectiveness, implementability, and cost. The selected remedy provides a higher degree of short-term effectiveness and implementability because the excavated soil is immediately disposed offsite without on-site treatment. There is no additional handling of chromium soil which results in less exposure to the community and environment. Additionally, the remedy can be completed in three months less time than the Ex Situ alternative and at a lower cost.

The selected remedy has been accepted by USEPA and the State; no objection has been made by the community.

Preference for Treatment as a Principal Element

The selected remedy does not satisfy the statutory preference for remedies that employ treatment as a principal element. Whether or not the TCE is treated off-site disposal is required for the chromium due to the threat to human health posed by the levels (treatment will be accomplished at the disposal facility if necessary to meet land ban disposal standards). The selected remedy requires less hazardous materials handling, exposes the community and environment to less volatiles, generates less residual waste, and does not impact clean areas where treatment would occur. The increased hazards of on-site treatment for TCE outweigh the benefits to satisfy the statutory preference for remedies that employ treatment as a principal element.

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11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The PP was released for public comment in March 1993. The PP identified Alternative 1B, extraction and treatment by air stripping, as the preferred alternative for groundwater. Since the issuance of the PP, the AF has developed, with close support and input from the local water agencies, an AF off-base water supply contingency policy. The policy documents the strategy to mitigate adverse effects on off-base municipal water production in the event that migration of contaminants from Norton AFB impacts production wells above the cleanup standards. The AF mitigation activities will include providing water treatment facilities at the affected water supply wells or providing alternate water supplies as appropriate, and reimbursement of affected water supply agencies for the cost of additional sampling, water quality tests, operation and maintenance, engineering, and related work. The specifics are discussed in the Norton AFB Off-Base Water Supply Contingency Policy; the mitigation activities will be implemented as outlined in the decision matrix presented in the policy. The wellhead water treatment facilities will consist of mobile GAC treatment units, which differs from the preferred alternative of air stripping as the only treatment method employed. To accommodate this change, wellhead treatment or provision of water supplies is included as part of the selected remedy.

The PP identified four options for releasing treated groundwater: release to water purveyors, reinjection, on-base industrial use, and discharge to the Santa Ana River. Since the issuance of the PP, the AF has selected reinjection as a beneficial and implementable enduse option and has included it in the groundwater remedy. The reinjection standard issue between the State of California and the AF has been resolved through acceptance of Resolution 68-16 as an ARAR. For reinjection inside the plume, reinjection concentrations will not exceed the MCL cleanup standards; outside of the plume, reinjection concentrations will not exceed 0.5 µg/L. This reinjection standard will comply with State Resolution 68-16. Release to water purveyors was not selected due to the difficulties in identifying purveyors able to take all treated groundwater year-round. Similarly, on-base uses could not utilize the volume of treated groundwater year-round. Discharge to the Santa Ana River wash, the AF's least preferred option, was not selected because it could be detrimental to the Santa Ana woolly star, an endangered species that lives within and around the wash. With the rejection of surface water discharge, the Endangered Species Act is no longer triggered and therefore not an ARAR; the habitat of the Santa Ana woolly star is at least one mile from the CBA and any areas impacted by selected remedies. A biological assessment was conducted by the U.S. Fish and Wildlife Service in 1990 and the California Department of Fish and Game in 1991 to determine the sensitive habitat areas at Norton AFB.

The PP identified the following as the preferred alternatives for soil:

- Deep Subsurface Soil - Alternative 2C, treatment by in situ SVE.
- Shallow Subsurface Soil (TCE Only) - Alternative 3C, excavation, ex situ SVE, and on-base use of treated soil for Building 658; Alternative 3D, treatment by in situ SVE at Building 763.
- Shallow Subsurface Soil (TCE and Chromium) - Alternative 4B, excavation and disposal offsite.

The AF reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the soil remedies, as they were originally identified in the PP, was necessary.

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APPENDIX A

RESPONSIVENESS SUMMARY

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**NORTON AIR FORCE BASE, SAN BERNARDINO, CALIFORNIA
RESPONSIVENESS SUMMARY
FOR THE CENTRAL BASE AREA OPERABLE UNIT PROPOSED PLAN**

A. OVERVIEW

At the time of the public comment period, the Air Force (AF) identified its preferred alternatives in the Proposed Plan (PP) for the Norton Air Force Base (AFB) Central Base Area (CBA) Operable Unit (CBA OU) in San Bernardino, California. The Air Force's recommended alternatives address the groundwater and soil contamination within the CBA OU only. The preferred alternatives specified in the PP would involve the following:

- Groundwater. Treatment would involve air stripping. The treated groundwater would be supplied to local water purveyors.
- Deep Subsurface Soil. Treatment would involve in situ soil vapor extraction (SVE). Extracted vapor is treated with activated carbon.
- Shallow Subsurface Soil (TCE Only). Treatment would involve both in situ SVE and excavation with ex situ SVE. Extracted vapor is treated with activated carbon.
- Shallow Subsurface Soil (TCE and Chromium). Treatment would involve excavation and off-site disposal.

Judging from the comments received during the public comment period, the residents, City of Riverside, and San Bernardino International Airport Authority (SBIAA) generally accept the AF's preferred remedial alternatives for addressing the groundwater and soil contamination. The primary concern expressed was the time frame for implementing the action and whether the actions would impede the base closure process.

These sections follow:

- Background on Community Involvement.
- Summary of Comments Received During the Public Comment Period.
- Remaining Concerns.

B. BACKGROUND ON COMMUNITY INVOLVEMENT

The AF disseminated periodic Fact Sheets to the community on the progress of the Remedial Investigation/Feasibility Study (RI/FS). The Fact Sheets are geared to inform the community and solicit any comments and concerns.

The concerns of the community have been the occasional and historical detections of trichloroethylene (TCE) and other volatile organic compounds (VOCs) above the maximum contaminant level (MCL) in downgradient municipal supply wells (Warren #2, Norman Road). The City of Riverside, who owns many of the production wells, has requested some type of compensation from the AF for lost production due to impacts from plume migration or extraction. The AF developed a water supply contingency policy to address this issue. As part of the preferred

groundwater treatment remedy, treated water would be provided to the City of Riverside to supplement their current supply should the production wells become affected.

C. SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD

Comments raised during the Norton AFB public comment period on the Final CBA OU FS and PP are summarized below. The comment period was held from February 16 to March 18, 1993. All comments received during the comment period are contained in the Administrative Record. The comments are categorized by the order in which they were received.

PUBLIC MEETING

1. A citizen questioned the AF's use of the 5 ppb MCL as a cleanup standard and asked if there was a possible Supreme Court ruling stating if a contaminant concentration of zero is technologically attainable, it should be attained.

Air Force Response: The AF has selected the MCL as the cleanup standard for groundwater. MCLs are promulgated drinking water standards established under the Safe Drinking Water Act for the protection of human health and the environment. These levels are both legally enforceable and obtainable. The AF notes that the 5 ppb limit is the maximum concentration that would be allowed and it expects that water provided to the water purveyors will contain less than 5 ppb of TCE. The AF is not aware of any recent or upcoming Supreme Court ruling requiring attainment of zero concentrations for soils or groundwater.

2. A citizen would like to know if (a) the low level radioactive waste the AF is concerned about includes the nuclear warheads that are currently being dismantled at the base, and (b) whether the air stripping tower will meet air emission regulations.

Air Force Response:

(a) The AF would like to stress there are no nuclear warheads being dismantled at Norton AFB. The low level radioactive waste mentioned during the Community Meeting represents a concrete bunker used in the 1950s and 1960s for storage of paint and paint waste containing radium. The AF is continuing efforts to locate the site. This work, however, is not part of the CBA OU but will be handled under proposed radiological studies.

(b) Air stripping tower emissions of VOCs, including naturally occurring radon gas, will be below the limits regulated by the South Coast Air Quality Management District (SCAQMD).

3. Senior aide to Congressman George Brown stated that the Congressman and many local citizens would like to see negotiations between the AF and the USEPA and the State of California on remedy selection and implementation move at a faster pace than it has to date.

Air Force Response: The AF shares the concerns of Congressman Brown and the local citizens. Given the constraints of the Superfund process and Federal Facility Agreement (FFA) that the AF has signed in good faith with the USEPA and the State of California, who are overseeing the clean-up process, the AF has been progressing as fast as it can to implement a clean-up action.

4. An unidentified citizen would like to know the cost and growing cost of clean-up.

Air Force Response: For groundwater, the present worth value cost for cleanup for a 30 year period of performance is estimated to be \$28,050,000. The clean-up cost will increase to \$37,560,000 if air emission standards become more stringent in the future and emission controls are needed on the air stripping towers. For the soil, the present worth value cost for cleanup is estimated to be \$5,257,000.

5. A citizen requested an explanation of the soil clean-up method, the time frame for completion, and whether any health threat to the public during implementation will exist.

Air Force Response: The AF proposes to use SVE to remove the TCE in soil to the lowest practicable level that can be achieved with the technology based on site conditions. The technology can be constructed and implemented in such a way as not to interfere or impede with base closure. Emissions from the extraction system will be treated to ensure that local air emission standards are not exceeded. The public will not come in contact with affected soil or vapors during treatment.

6. A citizen would like to know when the remedial actions will be implemented and whether they will be implemented by base closure.

Air Force Response: It is the AF's intent to implement the remedial actions as soon as possible. The AF, however, must comply with the requirements of the FFA. Notwithstanding unforeseen circumstances, remedial action construction should occur before or during base closure. However, it is unlikely that the cleanup, particularly for the groundwater, will be completed at base closure.

WRITTEN COMMENTS

Concerned Citizen

7. A citizen recommended that extraction wells be placed at the leading edge of the plume to impede the migration.

Air Force Response: As stated in the PP, the AF evaluated four different extraction scenarios, including extraction at the leading edge of the plume. The AF prefers extraction at the base boundary and central portion of the plume because this will be the most effective means to control plume movement and remove the most contaminated portion of the plume before it migrates offbase. Leading edge extraction may not be the most effective way to control the plume off-base. The AF has established a Water Supply Contingency Policy to be implemented should production wells become contaminated.

San Bernardino International Airport Authority (SBIAA)

8. The SBIAA requested that the AF substantiate that all other VOCs present that exceed MCLs will also be reduced to concentrations below their MCLs as part of the projected effort to remove TCE from groundwater.

Air Force Response: The principle of air stripping is based on the difference in volatility of various VOCs to that of water. The Henry's Law constant of a VOC describes its volatility and ease of stripping. In-general, the larger the Henry's Law constant, the easier the

compound is to strip. At 25°C (standard temperature), the Henry's Law constant for TCE is $9.10\text{E-}3 \text{ atm-m}^3/\text{gmol}$. The other VOCs detected above the MCL in the TCE plume (cis-1,2-dichloroethylene, 1,2-dichloroethane, vinyl chloride, and benzene) have Henry's Law constants similar to that of TCE, and therefore will exhibit a similar rate of stripping. If, for example, the rate of TCE removal is predicted as 95%, the removal rate for other VOCs with similar Henry's Law constants will also be around 95%. In summary, all VOCs commingled with TCE that exceed MCLs will be treated to below MCLs. It should be noted that TCE has been identified as the primary contaminant of concern in groundwater because it is the most widespread and it occurs at the highest concentrations. All other VOCs that exceed MCLs occur within the TCE plume and have been detected at concentrations significantly lower than that of TCE.

9. The SBIAA agreed that the clean-up standard of 5 parts per billion (ppb) for TCE in groundwater is protective of human health in accordance with current federal and state guidance. The SBIAA also agreed that the clean-up standard of 150 parts per million (ppm) of chromium in soil is protective of human health based upon ingestion.

Air Force Response: The AF acknowledges SBIAA's agreement.

10. The SBIAA recommends evaluating the potential for present or residual levels of TCE to volatilize, particularly inside buildings, because it may pose a potential health risk.

Air Force Response: As part of the proposed SVE treatability study, the AF will evaluate the potential for TCE emissions at the surface. It is important to note that enclosed spaces, such as a basement, do not exist in any of the buildings on the base. Buildup of volatilized TCE, if any, inside a building is unlikely.

11. The SBIAA recommends that an evaluation of the health risk from chromium in air-borne dust be included as part of the human-health protectiveness evaluation.

Air Force Response: The baseline risk assessment evaluated the potential risk to human and environmental receptors if no action occurs. In the risk assessment, there is no inhalation exposure pathway for chromium in soil because the area of soil contamination is covered with approximately 1 ft of concrete and is located inside a building. The AF, however, will remediate soil containing chromium and TCE because no action is not acceptable.

12. The SBIAA recommended monitoring for other VOCs that currently exceed the MCL until they fall below the MCL thresholds.

Air Force Response: The AF has been and will continue to monitor for all VOCs that are present in groundwater during the course of the remedial action.

13. In reference to the various enduse options for treated groundwater, the SBIAA concurred with the State of California that any reinjection of treated effluent outside of the plume should be treated to the lowest practical level that can be achieved with air stripping. Although the clean-up standard for TCE is the MCL, the SBIAA believes it would be inappropriate to transfer water containing TCE below the MCL to the regional aquifer offsite.

Air Force Response: The AF's preference for the treated water would be to provide it to the local water purveyors should they choose to receive it. The AF has selected reinjection because issues surrounding year around acceptance of the water could not be resolved at the time of issuance of the ROD. Any water reinjected would meet state and federal regulations for reinjection.

14. The SBIAA concurred with the AF's choice of a composite preferred clean-up method for the TCE- and chromium-contaminated soil.

Air Force Response: The AF acknowledges SBIAA's concurrence.

15. The SBIAA requested clarification on the soil clean-up time frames.

Air Force Response: The clean-up time frames presented are an estimate on the minimum time that would be required to accomplish the action under ideal conditions. The accuracy is + 50% to -30%.

16. The SBIAA requested that the AF substantiate the claim that TCE in soil at 1 to 69 ppm does not constitute a hazard, particularly in future circumstances when construction may expose TCE contaminated soil in this range.

Air Force Response: TCE in soil has been detected between 1 and 69 ppm. The baseline risk assessment evaluated the potential risk from ingestion and direct contact from this soil to future residents and workers. To be protective of human health, the cancer risk of a compound should be at least within 1 in 10 thousand to 1 in 1 million. For an industrial worker, or someone who would be involved with future construction at the site, the cancer risk from ingestion of and direct contact with soil were determined to be 1.8 in 100 million and 1.2 in 10 million, respectively. If, under future circumstances, a worker was exposed to TCE under the same conditions evaluated in the baseline risk assessment, the exposure would not pose a risk to human health, as shown above.

17. The SBIAA would like to know why the potential residual concentration of TCE remaining in soil after SVE is completed was not estimated.

Air Force Response: To estimate the residual TCE concentration that will remain after SVE is implemented, it is necessary to first perform a test of the technology, or a treatability study, on site-specific soil to determine how much can actually be removed. The AF is currently planning the treatability study for the site. Under the study, estimates on the mass of TCE that can be removed (or that will remain) will be determined.

18. The SBIAA would like to know how the AF will address TCE-contaminated soil beneath structures if SVE is unable to reduce the TCE concentrations to acceptable levels, or if vapor recovery cannot be completed before an area is scheduled for construction.

Air Force Response: If SVE is unable to reduce the TCE concentrations to acceptable levels, the other remedial alternative technologies identified in the CBA OU FS (i.e., excavation and ex situ treatment) will be reevaluated for application. Future construction should not be impeded by the operation of the soil gas extraction system as long as the AF is given sufficient lead time to complete the remediation.

19. The SBIAA would like to know what obligations the AF would have if additional contaminated sites are encountered (such as below another structure or paved area) after the cleanup in the CBA OU PP is completed.

Air Force Response: The CBA OU addresses only TCE-contaminated groundwater and the sources of TCE that have contributed to it. The cleanup presented in the CBA OU PP only addresses these concerns. Other known or recently identified potential source areas have been or will be characterized and mitigated under a separate clean-up program currently in progress and presented in a separate PP.

20. The SBIAA would like to know whether the soil excavation sites will be filled with clean soil, and the time frame for completing this task.

Air Force Response: All excavations will be immediately backfilled with clean soil following excavation of contaminated material to minimize disruptions to base activities.

City of Riverside

21. The City of Riverside acknowledged that the off-base portion of the TCE plume has not been completely defined and supported the AF's issuance of additional fact sheets on ongoing activities to further define the plume boundaries.

Air Force Response: The AF appreciates Riverside's interest and concern and will continue to issue fact sheets to inform the surrounding community of actions at Norton AFB.

22. The City of Riverside expressed an interest in assisting the AF in finalizing the decision on a clean-up method, as they own several wells that are within the migration path of the TCE plume.

Air Force Response: The AF acknowledges Riverside's concern regarding cleanup and appreciates their support and input on the final decision regarding clean-up methods.

23. The City of Riverside agreed with the proposed clean-up technologies. However, for reinjection of treated water outside the plume, Riverside agreed with the State of California's position that treatment and discharge limits be based on the best practical treatment methods (State Resolution 68-16).

Air Force Response: The AF acknowledges Riverside's acceptance of the proposed clean-up technologies. The AF has proposed to treat water by air stripping, which is considered the best demonstrated control technology, to groundwater treatment standards set to state and federal MCLs, and to use MCLs as the standard for reinjection. The USEPA requires that the AF identify a treated water standard. Thus the AF has identified MCLs as the reinjection standard inside the plume because they are protective of human health. This represents the maximum concentration released. Because the AF is using best demonstrated control technology, it believes that it can achieve a lower level and comply with Resolution 68-16; the reinjection standard outside of the plume will be 0.5 ppb.

The AF would prefer to transfer treated water to water purveyors over reinjection should the water purveyors be able to accept treated water from the air stripping tower. In the PP the AF considered four treated water enduse options in the following order of preference: transfer to water purveyors, on-base use, reinjection, and surface water discharge.

However, because the water purveyors have expressed concerns about receiving the water, the AF has selected reinjection as the preferred discharge option.

24. The City of Riverside suggested that the AF substitute "MCL" for the 5 ppb TCE groundwater clean-up standard because MCLs may change in the future before remediation is completed.

Air Force Response: As part of the Superfund process, the selected remedy is subjected to a review every five years. As part of this review, the clean-up standards (MCLs, which are promulgated drinking water standards) are reviewed. If, however, the current MCLs are identified as no longer protective, the groundwater clean-up standards will be reviewed and changed to reflect any promulgated changes in MCLs; this may occur at any time during implementation of the treatment remedy.

25. The City of Riverside requested that the AF redefine the area of groundwater contamination based on the proposed State of California Recommended Public Health Level (RPHL) for TCE (2.5 ppb).

Air Force Response: The AF defined groundwater contamination based on the TCE clean-up standard for groundwater (5 ppb). RPHLs were not used because, unlike MCLs, these levels are proposed and not promulgated standards. As part of the FS, a risk analysis was performed to determine whether cleanup to MCLs would pose an adverse risk to human health. The analysis showed that removal of TCE and other VOCs to their MCLs resulted in a cumulative risk level that was protective of human health.

26. The City of Riverside expressed concern that the AF did not consider the synergistic effects resulting from exposure to two or more contaminants in estimating health risks presented in the Proposed Plan.

Air Force Response: The health risks presented in Table 2 of the PP represent the risk to human health from all compounds evaluated in the baseline risk assessment. The baseline risk assessment, which evaluated the risk to human health assuming no remedial action is taken at the site, did not evaluate synergistic effects of two or more contaminants; there are no data to support synergism at low concentrations. The results of the risk assessment, however, indicated an adverse risk to human health; in response, the AF has proposed remedial actions to reduce the risk to acceptable levels. Therefore, a study of synergistic effects in relation to health affects is not necessary.

27. Based on the presence of vinyl chloride detected in groundwater and the proposed soil gas vinyl chloride sampling, the City of Riverside requested that the AF sample for vinyl chloride in soil gas during the duration of the clean-up effort and consider sampling for vinyl chloride in groundwater if water levels rise.

Air Force Response: Proposed soil gas sampling will provide the AF with initial information on soil gas concentrations. This information will be used during design and implementation of the SVE clean-up remedy. As part of the SVE remedy, soil gas will be continually monitored for VOCs, including TCE and vinyl chloride. Soil gas treatment will be performed as necessary to meet air quality regulations. The need for long-term soil gas monitoring will be determined after completion of the soil gas studies. Groundwater will be monitored quarterly as part of the groundwater remedy, regardless of water levels. The ongoing groundwater monitoring will involve analysis for VOCs, including TCE and vinyl chloride.

28. The off-base plume is affected by the pumping of off-base production wells, some of which are owned by the City of Riverside. The City of Riverside stated they should be held "harmless" for any effects because some wells have been operating prior to the inception of Norton AFB. Riverside has requested that the AF identify which wells may be causing the plume to deepen. If these wells must be shut down to prevent additional plume migration, Riverside requested the AF provide replacement potable water.

Air Force Response: The large number of production wells operating downgradient of Norton AFB is believed to have some effect on the migration of the off-base plume. These wells, owned by Riverside and others, operate at different pumping rates throughout the year. It is very difficult for the AF to identify which wells are causing the plume to deepen and migrate and at what pumping rate. The AF will be performing additional field work, which should provide information on pumping influences. After this information has been evaluated, the AF and the City of Riverside can negotiate any actions that may be required.

29. The City of Riverside agreed that the plume would be harder to control off-base than at the base boundary and therefore supports a base boundary system. Although exact well placement is not yet known, Riverside requested that proposed extraction and reinjection wells be placed to efficiently capture the plume and limit or stop off-base migration. Specifically, Riverside requested the AF consider placing extraction wells between the proposed base boundary system and existing production wells.

Air Force Response: As Riverside has acknowledged, the plume would be difficult to control off-base. The AF did consider extraction wells at the leading edge of the plume, but has chosen the following approach as the optimum extraction scenario: extraction at the base boundary to control and capture the most contaminated portion of the plume before it migrates offbase and contaminates a larger volume of groundwater, completion of off-base plume characterization, and extraction and treatment at affected production wells. As part of the off-base characterization, the AF will determine the necessity for an extraction system at the leading edge of the plume. The exact number and placement of extraction wells at the base boundary will be determined during the remedial design phase. It is the intent of the AF to strategically place extraction wells to capture the plume as effectively as is feasible.

30. The City of Riverside expressed concern that extraction wells could impact off-base production wells and requested that the AF compensate local water purveyors if extraction wells cause excessive interference with production, or costs of production, from existing municipal wells.

Air Force Response: The base boundary extraction wells will be screened in the shallow portion of the aquifer, therefore it is unlikely that they will impact deeper off-base production wells. In addition, it is the AF's preference to reinject extracted water, an action which would not reduce the total volume of water available for use by the water purveyors. The AF will work with the San Bernardino Watermaster and local water purveyors to establish an acceptable extraction plan.

31. The City of Riverside requested that the AF notify its neighbors of the outcome of discussions with the SCAQMD regarding air stripping emissions.

Air Force Response: As stated in the PP, the off-gas emissions from the air stripping tower are estimated to be below regulatory limits. The AF will continue to evaluate the estimated

emission rates through remedial design and action period. During this time the AF will work with the SCAQMD to ensure compliance and protection of public health. The results of discussions with the SCAQMD regarding air stripping emissions will be presented in community fact sheets describing startup of the remedial action.

32. The City of Riverside has stated its interest in purchasing treated water but requested the AF treat the water to all applicable drinking water requirements and to discharge standards applicable to the Riverside Regional Wastewater Treatment Facility, including those for total dissolved solids and nitrates; provide the water at the required pressure at specified locations; and sell the water at a cost not to exceed the avoided costs of local production.

Air Force Response:

The AF considers transferring treated groundwater to local water purveyors a beneficial treated water enduse option and acknowledges Riverside's interest in purchasing treated water. However, since the issuance of the PP the AF has resolved the reinjection standard issue over State Resolution 68-16 and has selected reinjection as the treated groundwater enduse option. The AF will treat groundwater to the clean-up standards, which have been established at MCLs (drinking water standards), for those constituents for which the AF is responsible before reinjection. The AF does not propose to release water to a publicly-owned treatment works (POTW) and therefore treatment to POTW standards is not relevant under state and federal law. The AF will only be required to treat water to remove AF contamination.

33. The AF has proposed to treat groundwater at a production well when TCE is detected in the well above the MCL for an extended period of time. Riverside requested the AF begin wellhead treatment when the concentration of tetrachloroethylene, vinyl chloride, or any other TCE degradation by-product exceeds its respective MCL. Riverside suggested the AF provide interim replacement potable water during installation of the wellhead treatment facilities. In addition, Riverside requested that the AF expedite the approval process of the Water Supply Contingency Policy for replacing lost production due to contamination from Norton AFB.

Air Force Response: The groundwater plume contains mainly TCE, with 1,2-dichloroethylene, tetrachloroethylene, vinyl chloride, and other VOCs at lower concentrations. It is on this basis that the AF had proposed wellhead treatment based on TCE concentrations. However, recent off-base groundwater data show some areas with 1,2-dichloroethylene concentrations. The AF recognizes this concern and proposes to implement the Water Supply Contingency Policy when TCE or any of its degradation products are present above their MCLs, as outlined in the Policy.

34. The City of Riverside expressed concern over the issue of deed restrictions to prohibit drilling of domestic wells on off-base property where the plume has migrated. Riverside acquired off-base property for siting new municipal wells to replace older wells or install deeper wells screened below the level of contamination. Riverside requested that the AF allow the deed restrictions to (a) permit drilling of replacement wells and new wells provided the groundwater will be treated or blended, or the wells are screened below and/or isolated from contaminated groundwater, and (b) propose how owners of affected properties will be compensated.

Air Force Response: The AF does not plan to establish deed restrictions on property it does not currently own. Deed restriction will be placed on Norton AFB property that overlies the contaminated groundwater or soil source area until the cleanup standard has been achieved. The AF suggests that the City of Riverside contact state or local authorities if it has further concerns on this matter.

35. The City of Riverside requested that the AF establish a set of performance indicators to assess progress of the clean-up process, and periodically review and update the selected remedy as technologies continue to evolve.

Air Force Response: During the remedial design phase, performance standards for the selected remedy will be set. During the 5-year review of the remedial action, the remedy will be evaluated based on the performance standards to assess the progress and success of cleanup. The review includes an examination of new and evolved technologies to determine whether the current remedy should be replaced or updated with a more effective technology.

D. REMAINING CONCERNS

Issues and concerns that the AF was unable to address during remedial planning activities include the following:

- How much residual TCE will remain after SVE, and what health risks are associated with volatilization of the residual TCE? The AF is unable to address this issue since the SVE treatability study has yet to be performed. It should be noted, however, that the present levels of TCE in soil are at acceptable human health risk levels (less than 10^{-6}). The risk is within the acceptable range of 10^{-4} to 10^{-6} . The risk that drives implementation of an action is protection of groundwater. After any action is complete, the risk from any residual TCE should be even less.
- How will the Air Force compensate water purveyors if the proposed extraction wells cause excessive interference with production or production costs? The AF does not anticipate this to be a problem. Should it occur, the AF will reevaluate the extraction scheme.
- The Air Force should expedite the approval process of the Water Supply Contingency Policy for replacing lost production due to contamination from Norton AFB. The AF appreciates the City's concern. The Water Supply Contingency Policy is currently being reviewed by AF legal staff prior to signature by the Secretary of the AF.
- The City of Riverside should be held harmless in any spreading of the plume which may have occurred due to operation of the production wells. Comment noted.
- Where will off-base extraction wells be placed? Why are there no plans to place wells at the leading edge of the plume? Field work to define the leading edge of the plume and study the effects of production wells on the plume is presently ongoing. Placement of off-base wells, if necessary, and effectiveness will be determined during remedial design.

APPENDIX B

ADMINISTRATIVE RECORD INDEX

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NORTON AIR FORCE BASE (NAFB)

ADMINISTRATIVE RECORD FILE

INDEX

FOR

OPERABLE UNIT #1

INSTALLATION RESTORATION PROGRAM

November 1993

**OL-E, AFBDA/SPEV - Building S-2
Norton Air Force Base, California 92409-5000**

B-1

(91)

INDEX MODEL

- Category Number** - Indicates the Administrative Record file structure. Name Category here.
- Document Number** - Comprised of a 3 letter/digit site code (OU1) and the number of pages in a document. If documents are eventually placed on a microfiche system, the document number consists of the site code followed by the microfilm reel and frame number.
 Example: OU1(1.1) #1 104
- | <u>Site Code</u> | <u>(Categ.#)</u> | <u>Entry #</u> | <u># Pages</u> |
|------------------|------------------|----------------|----------------|
| OU1 | (1.1) | #1 | 104 |
- Long Title** - The long title and brief description of document.
- Author** - Indicates author or primary originator of document. If a contractor prepared the document, indicate company and origin.
- Recipient** - Indicates primary recipient and other addressees.
- Date** - Indicates document date by month/day/year.
- Type** - Indicates document type (final plan, graphic, correspondence, draft, manual).
- Government regulations and internal DoD comments
 - Public Comments
- Second Reference** - Categories which may also include document.
- Location** - Exact location(s) of document.

ADMINISTRATIVE RECORD FILE STRUCTURE

1.0 SITE IDENTIFICATION

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- 1.2 Notification/Site Inspection Reports
- 1.3 Preliminary Assessment (PA) Report
- 1.4 Site Investigation (SI) Report
- 1.5 Previous Operable Unit Information
- 1.6 Correspondence

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- 2.2 Sampling and Analysis Data/Chain of Custody
- 2.3 EE/CA Approval Memorandum (non-time-critical removals)
- 2.4 EE/CA (Engineering Evaluation/Cost Analysis)
- 2.5 Action Memorandum
- 2.6 Amendments to Action Memorandum
- 2.7 Sampling Results
- 2.8 Correspondence

3.0 REMEDIAL INVESTIGATION (RI)

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- 3.2 Sampling and Analysis Data/Chain of Custody Forms
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- 3.4 Remedial Investigation (RI) Reports
- 3.5 Health & Safety Plans
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4.0 FEASIBILITY STUDY (FS)

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- 4.2 Feasibility Reports
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5.0 RECORD OF DECISION (ROD)

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- 5.4 Correspondence

6.0 STATE AND FEDERAL COORDINATION

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- 6.2 Federal Facility Agreement (FFA)
- 6.3 State Certification of ARARs
- 6.4 General Correspondence

7.0 ENFORCEMENT

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- 7.2 Endangerment Assessments
- 7.3 Administrative Orders
- 7.4 Consent Decrees
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- 7.7 Notice Letters and Responses

- 8.0 HEALTH ASSESSMENTS**
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 - 8.2 Toxicological Profiles
 - 8.3 General Correspondence

- 9.0 NATURAL RESOURCE TRUSTEES**
 - 9.1 Notices Issued
 - 9.2 Findings of Fact
 - 9.3 Reports
 - 9.4 General Correspondence

- 10.0 PUBLIC PARTICIPATION**
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 - 10.3 Public Notice(s) (Availability of the Admin. Record File, Availability of the Proposed Plan, Public Meetings)
 - 10.4 Public Meeting Transcripts
 - 10.5 Documentation of other Public Meetings
 - 10.6 Fact Sheets, Press Advisories and News Releases
 - 10.7 Responsiveness Summary
 - 10.8 Late Comments
 - 10.9 Technical Review Committee Charter

- 11.0 TECHNICAL SOURCES AND GUIDANCE DOCUMENTS**
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 - 11.3 State Guidance
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- 12.0 CONFIDENTIAL FILE**
 - 12.1 Privileged Documents (Extractions)

"This Administrative Record Index contains documents directly considered or relied on to select the remedial action for the Central Base Area Operable Unit. For this reason, many sections contain no document references and primary document references are not sequentially numbered."

1.3 Preliminary Assessment (PA) Report

DOCUMENT NUMBER: OU1 (1.3) #1 240
LONG TITLE: "Installation Restoration Program, Phase I: Records Search, Norton AFB, CA"
AUTHOR: Engineering-Science, Inc., Atlanta, GA
RECIPIENT: AFESC/DEV, Tyndall AFB, FL
HQ MAC/DEEV, Scott AFB, IL
DATE: 10/82
TYPE: Final report
SECOND REFERENCE: IRP, Phase 1
LOCATION: ARF

DOCUMENT NUMBER: OU1 (1.3) #2 70
LONG TITLE: "Final TCE Records Investigation Report, Near the Central Base Area, Norton AFB, CA, Volume 1"
AUTHOR: CDM Federal Programs Corporation, San Francisco, CA
RECIPIENT: Martin Marietta Energy Systems, Inc., HAZWRAP and HQ MAC
DATE: 08/90
TYPE: Report
SECOND REFERENCE: CBA, TCE Investigation
LOCATION: ARF

DOCUMENT NUMBER: OU1 (1.3) #3 120
LONG TITLE: "Final TCE Records Investigation Report, Near the Central Base Area, Norton AFB, CA, Volume 2"
AUTHOR: CDM Federal Programs Corporation, San Francisco, CA
RECIPIENT: Martin Marietta Energy Systems, Inc., HAZWRAP and HQ MAC
DATE: 08/90
TYPE: Report
SECOND REFERENCE: CBA, TCE Investigation
LOCATION: ARF

1.4 Site Investigation (SI) Report

DOCUMENT NUMBER: OU1 (1.4) #1 300
LONG TITLE: "Installation Restoration Program, Final Report, Phase II, Stage 1 - Problem Confirmation Study, Norton Air Force Base, S.B. California, Volume I -- Technical Report"
AUTHOR: Roy F. Weston, Inc., West Chester, Pennsylvania
RECIPIENT: USAF Occupational and Environmental Health Laboratory, Brooks AFB, TX
DATE: 07/16/85
TYPE: Report
SECOND REFERENCE: IRP, Phase 2, Stage 1
LOCATION: ARF

DOCUMENT NUMBER: OU1 (1.4) #2 500
LONG TITLE: "Installation Restoration Program, Final Report, Phase II, Stage 1 - Problem Confirmation Study, Norton Air Force Base, S.B. California, Volume II-- Appendices"
AUTHOR: Roy F. Weston, Inc., West Chester, Pennsylvania
RECIPIENT: USAF Occupational and Environmental Health Laboratory, Brooks AFB, TX
DATE: 07/16/85
TYPE: Report
SECOND REFERENCE: IRP, Phase 2, Stage 1
LOCATION: ARF

1.5 Previous Operable Unit Information

DOCUMENT NUMBER: OU1 (1.5) #2 80
LONG TITLE: Well Monitoring Data Report
AUTHOR: Ecology and Environment, Inc., Lancaster, NY
RECIPIENT: USAF, HQ MAC, Scott AFB, IL
USAF Occupational and Environmental Health Laboratory, Brooks
AFB, TX
DATE: 07/88
TYPE: Report
SECOND REFERENCE: IRP, Stage 1 and 2, Groundwater
LOCATION: ARF

3.1 Sampling and Analysis Plan (SAP)

DOCUMENT NUMBER: OU1 (3.1) #1 95
LONG TITLE: "Installation Restoration Program, Quality Assurance Project Plan (QAPP), Norton AFB, CA"
AUTHOR: Ecology and Environment, Inc., Buffalo, NY
RECIPIENT: Occupational and Environmental Health Laboratory, Technical Services Division, Brooks AFB, TX
DATE: 05/87
TYPE: Project Plan
SECOND REFERENCE: Lockheed, CBA
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.1) #2 156
LONG TITLE: "Quality Assurance Project Plan (QAPP), Installation Restoration Program, Stage 3 for Norton AFB, CA"
AUTHOR: Ecology and Environment, Inc., Buffalo, NY
RECIPIENT: HQ MAC/DEEV, Scott AFB IL Occupational and Environmental Health Laboratory, Technical Services Division, Brooks AFB, TX
DATE: 12/87
TYPE: Project Plan
SECOND REFERENCE: Lockheed, CBA
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.1) #4 130
LONG TITLE: "Final Quality Assurance Project Plan, Central Base Area Site Characterization for Norton AFB, CA"
AUTHOR: CDM Federal Programs Corporation, 301 Howard St., San Francisco, CA 94105
RECIPIENT: Martin Marietta Energy Systems, Inc.,
HAZWRAP, Oak Ridge, TN 37831
63 Air Base Group, Norton AFB, CA
DATE: 08/90
TYPE: Manual
SECOND REFERENCE: IRP, CBA
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.1) #5 100
LONG TITLE: "Final Field Sampling Plan, Site Characterization Groundwater Investigation for the Central Base Area of Norton AFB, CA, Volume I"
AUTHOR: CDM Federal Programs Corporation, 301 Howard St., San Francisco, CA 94105
RECIPIENT: Martin Marietta Energy Systems, Inc.,
HAZWRAP, Oak Ridge, TN 37831
63 Air Base Group, Norton AFB, CA

DATE: 08/90
TYPE: Manual (Revision 2)
SECOND REFERENCE: IRP, CBA, Groundwater Investigation
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.1) #6 100
LONG TITLE: "Final Field Sampling Plan, Site Characterization Groundwater Investigation for the Central Base Area of Norton AFB, CA, Volume II"

AUTHOR: CDM Federal Programs Corporation, 301 Howard St., San Francisco, CA 94105

RECIPIENT: Martin Marietta Energy Systems, Inc.,
HAZWRAP, Oak Ridge, TN 37831
63 Air Base Group, Norton AFB, CA

DATE: 08/90
TYPE: Manual (Revision 2)
SECOND REFERENCE: IRP, CBA, Groundwater Investigation
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.1) #7 50 See (3.1) #14
LONG TITLE: "Draft Final Addendum to TCE Source Investigation Field Sampling Plan"

AUTHOR: CDM FPC, San Francisco, CA

RECIPIENT: Martin Marietta, HAZWRAP, HQ MAC

DATE: 09/90

TYPE: Sampling Plan

SECOND REFERENCE: IRP, TCE Source Investigation
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.1) #10 110
LONG TITLE: "Final Field Sampling Plan, Site Characterization TCE Source Investigation for the Central Base Area of Norton AFB, San Bernardino, CA, Volume I"

AUTHOR: CDM Federal Programs Corporation, 301 Howard St., San Francisco, CA 94105

RECIPIENT: Martin Marietta Energy Systems, Inc.,
HAZWRAP, Oak Ridge, TN 37831
63 Air Base Group, Norton AFB, CA

DATE: 04/91

TYPE: Manual

SECOND REFERENCE: IRP, CBA, TCE Source Investigation
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.1) #11 100
LONG TITLE: "Final Field Sampling Plan, Site Characterization TCE Source Investigation for the Central Base Area of Norton AFB, San Bernardino, CA, Volume II"

AUTHOR: CDM Federal Programs Corporation, 301 Howard St., San Francisco, CA 94105
RECIPIENT: Martin Marietta Energy Systems, Inc.,
HAZWRAP, Oak Ridge, TN 37831
63 Air Base Group, Norton AFB, CA
DATE: 04/91
TYPE: Manual
SECOND REFERENCE: IRP, CBA, TCE Source Investigation
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.1) #12 50
LONG TITLE: "Field Sampling Plan for the Expedited Field Program, AF Building 763, Norton AFB, San Bernardino, CA"
AUTHOR: CDM Federal Programs Corporation, 301 Howard St., San Francisco, CA 94105
RECIPIENT: Martin Marietta Energy Systems, Inc.,
HAZWRAP, Oak Ridge, TN 37831
63 Air Base Group, Norton AFB, CA
DATE: 05/91
TYPE: Manual
SECOND REFERENCE: IRP, CBA, Building 763
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.1) #14 9
LONG TITLE: Final Addendum to TCE Source Investigation Field Sampling Plan
AUTHOR: CDM FPC, San Francisco, CA
RECIPIENT: Martin Marietta, HAZWRAP, HQ MAC
DATE: 12/91
TYPE: Sampling Plan
SECOND REFERENCE: IRP, TCE Source Investigation
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.1) #16 100
LONG TITLE: "Final Draft Treatability Test Plan Central Base Area Pump and Treat System, Norton AFB, San Bernardino, CA 92409"
AUTHOR: Earth Technology Corporation, Alexandria, VA
RECIPIENT: AFBDA, NAFB
DATE: 11/16/92
TYPE: Plan
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.1) #19 400
LONG TITLE: "Draft Groundwater Monitoring Plan"
AUTHOR: CDM Federal Programs Corporation, San Francisco, CA
RECIPIENT: Martin Marietta Energy Systems, Inc.,
HAZWRAP and HQ AFBDA

DATE: 10/21/92
TYPE: Plan
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.1) #20 150
LONG TITLE: "Draft Groundwater Monitoring Plan, Appendix A"
AUTHOR: CDM Federal Programs Corporation, San Francisco, CA
RECIPIENT: Martin Marietta Energy Systems, Inc.,
HAZWRAP and HQ AFBDA

DATE: 10/21/92
TYPE: Plan
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.1) #22 110
LONG TITLE: Final Second Addendum to the Field Sampling Plan Site
Characterization TCE Source Investigation Norton AFB, CA
AUTHOR: CDM Federal Programs Corp
RECIPIENT: Martin Marietta, HAZWRAP Division and AFBDA, Norton AFB, CA
DATE: 4/5/93
TYPE: Sampling Plan
SECOND REFERENCE: TCE Source Investigation (FSP)
LOCATION: ARF

3.3 Work Plan

DOCUMENT NUMBER: OU1 (3.3) #6 60
LONG TITLE: Draft Final Conceptual Design for Remedial Activities at Norton AFB, CA
AUTHOR: CDM Federal Programs Corporation, 301 Howard St., Suite 910, San Francisco, CA 94105
RECIPIENT: Martin Marietta Energy Systems, Inc., HAZWRAP, Oak Ridge, TN 37831
63 Air Base Group, Norton AFB, CA
DATE: 02/90
TYPE: Manual
SECOND REFERENCE: OU1 (11.7)
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.3) #8 60
LONG TITLE: Final Site Characterization Plan for the Central Base Area of Norton AFB, CA
AUTHOR: CDM Federal Programs Corporation, 301 Howard St., Suite 910, San Francisco, CA 94105
RECIPIENT: Martin Marietta Energy Systems, Inc., HAZWRAP, Oak Ridge, TN 37831
63 Air Base Group, Norton AFB, CA
DATE: 08/90
TYPE: Manual
SECOND REFERENCE: IRP, CBA
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.3) #11 50
LONG TITLE: Draft Final Monitoring Well Replacement Plan
AUTHOR: CDM Federal Programs Corporation, 301 Howard St., Suite 910, San Francisco, CA 94105
RECIPIENT: Martin Marietta Energy Systems, Inc., HAZWRAP, Oak Ridge, TN 37831
63 Air Base Group, Norton AFB, CA
DATE: 08/91
TYPE: Monitoring Plan
SECOND REFERENCE: None
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.3) #12 30
LONG TITLE: Final Monitoring Well Replacement Plan
AUTHOR: CDM Federal Programs Corporation, 301 Howard St., Suite 910, San Francisco, CA 94105
RECIPIENT: Martin Marietta Energy Systems, Inc.,

	HAZWRAP, Oak Ridge, TN 37831 63 Air Base Group, Norton AFB, CA
DATE:	12/91
TYPE:	Work Plan
SECOND REFERENCE:	None
LOCATION:	ARF
DOCUMENT NUMBER:	OU1 (3.3) #14 150
LONG TITLE:	Technical Memorandum, Rationale for Groundwater Sample Analytes, Comprehensive Groundwater Sampling, June 1992
AUTHOR:	CDM Federal Programs Corporation, 301 Howard St., Suite 910, San Francisco, CA 94105
RECIPIENT:	Martin Marietta Energy Systems, Inc., HAZWRAP, Oak Ridge, TN 37831 AFBDA, Norton AFB, CA
DATE:	04/29/92
TYPE:	Work Plan
SECOND REFERENCE:	None
LOCATION:	ARF
DOCUMENT NUMBER:	OU1 (3.3) #15 C52
LONG TITLE:	Final Operational and Maintenance Plan, NAFB, CBA - Volume I
AUTHOR:	Earth Technology Corporation, Alexandria, VA
RECIPIENT:	AFBDA, NAFB
DATE:	06/92
TYPE:	Plan
SECOND REFERENCE:	
LOCATION:	ARF
DOCUMENT NUMBER:	OU1 (3.3) #16 Loop 1400, 1500-5
LONG TITLE:	Final Operational and Maintenance Plan, NAFB Central Base Area
AUTHOR:	Earth Technology Corporation, Alexandria, VA
RECIPIENT:	AFBDA, NAFB
DATE:	06/92
TYPE:	Plan
SECOND REFERENCE:	
LOCATION:	ARF
DOCUMENT NUMBER:	OU1 (3.3) #17 500
LONG TITLE:	Final Operational and Maintenance Plan, NAFB, CBA
AUTHOR:	Earth Technology Corporation, Alexandria, VA
RECIPIENT:	AFBDA, NAFB
DATE:	06/92
TYPE:	Plan
SECOND REFERENCE:	
LOCATION:	ARF

DOCUMENT NUMBER: OU1 (3.3) #19 12
LONG TITLE: "Responses to Regulatory Agencies' Comments on the Draft Work Plan Aquifer Testing Southwestern Base Boundary, Norton AFB, CA"
AUTHOR: Earth Technology Corporation
RECIPIENT: AFBDA/SPEV, AFCEE
DATE: 11/16/92
TYPE:
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.3) #20 200
LONG TITLE: "Draft Final Work Plan Aquifer Testing Southwestern Base Boundary, Norton AFB, CA"
AUTHOR: Earth Technology Corporation, Alexandria, VA
RECIPIENT: AFBDA/SPEV, AFCEE
DATE: 11/17/92
TYPE: Work Plan
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.3) #21 223
LONG TITLE: Final Phase II Work Plan Addendum Off Base TCE Plume Investigation at Norton AFB, CA
RECIPIENT: Air Force Center for Environmental Excellence (AFCEE/ESR), Brooks AFB, TX and AFBDA, Norton AFB, CA
DATE: 5/10/93
TYPE: Work Plan
SECOND REFERENCE: CBA OU RI/FS
LOCATION: ARF

3.4 Remedial Investigation (RI) Reports

DOCUMENT NUMBER: OU1 (3.4) #1 350
LONG TITLE: Installation Restoration Program, Phase II --
Confirmation/Quantification, Stage 2, Norton AFB, CA, Final Report,
May 1986-September 1987, Volume I - Technical Report
AUTHOR: Ecology and Environment, Inc. 195 Holtz Dr., Buffalo, NY 14225
RECIPIENT: USAF, HQ MAC/SGPB, Scott AFB, IL
USAF Occupational and Environmental Health Laboratory, Brooks
AFB, TX AFBDA, Norton AFB, CA
DATE: 09/87
TYPE: Report
SECOND REFERENCE: IRP, Phase II, Stage 2
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #2 400
LONG TITLE: "Installation Restoration Program, Phase
II--Confirmation/Quantification, Stage 2, Norton AFB, CA, Final
Report, May 1986-September 1987, Volume 2, Appendices
A-G"
AUTHOR: Ecology and Environment, Inc., 195 Holtz Dr., Buffalo, NY 14225
RECIPIENT: USAF, HQ MAC/SGPB, Scott AFB, IL
USAF Occupational and Environmental Health Laboratory, Brooks
AFB, TX
DATE: 09/87
TYPE: Report
SECOND REFERENCE: IRP, Phase II, Stage 2
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #3 400
LONG TITLE: "Installation Restoration Program, Phase
II--Confirmation/Quantification, Stage 2, Norton AFB, CA, Final
Report, May 1986-September 1987, Volume 3, Appendix H,
Soils Data"
AUTHOR: Ecology and Environment, Inc., 195 Holtz Dr., Buffalo, NY 14225
RECIPIENT: USAF, HQ MAC/SGPB, Scott AFB, IL
USAF Occupational and Environmental Health Laboratory, Brooks
AFB, TX
DATE: 09/87
TYPE: Report
SECOND REFERENCE: IRP, Phase II, Stage 2
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #4 300
LONG TITLE: "Installation Restoration Program, Phase
II--Confirmation/Quantification, Stage 2, Norton AFB, CA, Final

Report, May 1986-September 1987, Volume 4A, Appendix H,
Water Data"
AUTHOR: Ecology and Environment, Inc., 195 Holtz Dr., Buffalo, NY 14225
RECIPIENT: USAF, HQ MAC/SGPB, Scott AFB, IL
USAF Occupational and Environmental Health Laboratory, Brooks
AFB, TX
DATE: 09/87
TYPE: Report
SECOND REFERENCE: IRP, Phase II, Stage 2
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #5 400
LONG TITLE: "Installation Restoration Program, Phase
II--Confirmation/Quantification, Stage 2, Norton AFB, CA, Final
Report, May 1986-September 1987, Volume 4B, Appendix H,
Water Data"

AUTHOR: Ecology and Environment, Inc., 195 Holtz Dr., Buffalo, NY 14225
RECIPIENT: USAF, HQ MAC/SGPB, Scott AFB, IL
USAF Occupational and Environmental Health Laboratory, Brooks
AFB, TX
DATE: 09/87
TYPE: Report
SECOND REFERENCE: IRP, Phase II, Stage 2
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #6 400
LONG TITLE: "Installation Restoration Program, Phase
II--Confirmation/Quantification, Stage 2, Norton AFB, CA, Final
Report, May 1986-September 1987, Volume 5, Appendices I-M"
AUTHOR: Ecology and Environment, Inc., 195 Holtz Dr., Buffalo, NY 14225
RECIPIENT: USAF, HQ MAC/SGPB, Scott AFB, IL
USAF Occupational and Environmental Health Laboratory, Brooks
AFB, TX
DATE: 09/87
TYPE: Report
SECOND REFERENCE: IRP, Phase II, Stage 2
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #7 250
LONG TITLE: "Installation Restoration Program, Stage 3; Norton AFB--Stage 3
Report--Vol. 1; Final Report, Sept 1987 -- Dec 1988"
AUTHOR: Ecology and Environment, Inc., Lancaster, NY
RECIPIENT: USAF HQ MAC/SGPB, Scott AFB IL
USAF Occupational and Environmental Health
Laboratory, Brooks AFB, TX
DATE: 12/88
TYPE: Manual
SECOND REFERENCE: IRP, Stage 3

LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #8 300

LONG TITLE: "Installation Restoration Program, Stage 3: Norton AFB--Stage 3, Final Report, Sept 1987 -- Dec 1988, Norton AFB--Appendices D-F"

AUTHOR: Ecology and Environment, Inc., Lancaster, NY

RECIPIENT: USAF HQ MAC/SGPB, Scott AFB, IL

USAF Occupational and Environmental Health
Laboratory, Brooks AFB, TX

DATE: 12/88

TYPE: Manual (Draft)

SECOND REFERENCE: IRP, Stage 3

LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #9 200

LONG TITLE: "Installation Restoration Program, Stage 3; Final Report, Sept 1987--
December 1988; Norton AFB--Appendices H-L"

AUTHOR: Ecology and Environment, Inc., Lancaster, NY

RECIPIENT: USAF HQ MAC/SGPB, Scott AFB IL

USAF Occupational and Environmental Health
Laboratory, Brooks AFB, TX

DATE: 12/88

TYPE: Report

SECOND REFERENCE: IRP, Stage 3

LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #10 500

LONG TITLE: Installation Restoration Program, Stage 3, Final Report: September
1987-December 1988

AUTHOR: Ecology and Environment, Inc., Lancaster, NY

RECIPIENT: HQ MAC/SGPB, Scott AFB, IL

DATE: 12/88

TYPE: Report

SECOND REFERENCE:

LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #11 70

LONG TITLE: "Installation Restoration Program, Stage 3; Groundwater Monitoring
Plan: March 1989"

AUTHOR: Ecology and Environment, Inc., Lancaster, NY

RECIPIENT: USAF HQ MAC/SGPB, Scott AFB, IL

USAF Occupational and Environmental Health
Laboratory, Brooks AFB, TX

DATE: 03/89

TYPE: Report

SECOND REFERENCE: IRP Stage 3

LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #12 50
LONG TITLE: Groundwater Monitoring Plan for Norton AFB, CA - Volume I
AUTHOR: Ecology and Environment, Inc., Lancaster, NY
RECIPIENT: HQ MAC/DE, Scott AFB IL
DATE: 09/89
TYPE: Report
SECOND REFERENCE: None
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #13 250
LONG TITLE: Installation Restoration Program, Groundwater Monitoring Plan, Volume II
AUTHOR: Ecology and Environment, Inc., Lancaster, NY
RECIPIENT: HQ MAC/DE, Scott AFB, IL
DATE: 04/89
TYPE: Report
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #14 120
LONG TITLE: "Installation Restoration Program, Stage 3, Volume I, Final Draft Report, September 1987--December 1988"
AUTHOR: Ecology and Environment, Inc., Buffalo Corporate Center, 368 Pleasantview Drive, Lancaster, NY 14086
RECIPIENT: USAF HQ MAC/DE, Scott AFB, IL
USAF Occupational and Environmental Health Laboratory (AFOEHL-AFSC), Technical Services Division (TS), Brooks AFB, TX
DATE: 11/89
TYPE: Report
SECOND REFERENCE: IRP Stage 3
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #15 400
LONG TITLE: "Installation Restoration Program, Stage 3, Volume II, Final Draft Report, September 1987--December 1988"
AUTHOR: Ecology and Environment, Inc., Buffalo Corporate Center, 368 Pleasantview Drive, Lancaster, NY 14086
RECIPIENT: USAF HQ MAC/DE, Scott AFB, IL
USAF Occupational and Environmental Health Laboratory (AFOEHL-AFSC), Technical Services Division (TS), Brooks AFB, TX
DATE: 11/89
TYPE: Report
SECOND REFERENCE: IRP, Stage 3
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #16 80
LONG TITLE: "Installation Restoration Program, Stage 3, Volume III, Final Draft

AUTHOR: Report, September 1987--December 1988"
Ecology and Environment, Inc., Buffalo Corporate Center, 368
Pleasantview Drive, Lancaster, NY 14086
RECIPIENT: USAF HQ MAC/DE, Scott AFB, IL
USAF Occupational and Environmental Health Laboratory
(AFOEHL-AFSC), Technical Services Division (TS), Brooks AFB, TX
DATE: 11/89
TYPE: Manual (Final Draft Report)
SECOND REFERENCE: IRP, Stage 3
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #17 400
LONG TITLE: "Installation Restoration Program, Stage 3, Appendices A-F, Final
Draft Report, September 1987--December 1988"
AUTHOR: Ecology and Environment, Inc., Buffalo Corporate Center, 368
Pleasantview Drive, Lancaster, NY 14086
RECIPIENT: USAF HQ MAC/DE, Scott AFB, IL
USAF Occupational and Environmental Health Laboratory
(AFOEHL-AFSC), Technical Services Division (TS), Brooks AFB, TX
DATE: 11/89
TYPE: Report
SECOND REFERENCE: IRP, Stage 3
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #18 400
LONG TITLE: "Installation Restoration Program, Stage 3, Appendix G, Final Draft
Report, September 1987--December 1988"
AUTHOR: Ecology and Environment, Inc., Buffalo Corporate Center, 368
Pleasantview Drive, Lancaster, NY 14086
RECIPIENT: USAF HQ MAC/DE, Scott AFB, IL
USAF Occupational and Environmental Health Laboratory
(AFOEHL-AFSC), Technical Services Division (TS), Brooks AFB, TX
DATE: 11/89
TYPE: Report
SECOND REFERENCE: IRP, Stage 3
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #19 500
LONG TITLE: "Installation Restoration Program, Stage 3, Appendix G (Continued),
Final Draft Report, September 1987--December 1988"
AUTHOR: Ecology and Environment, Inc., Buffalo Corporate Center, 368
Pleasantview Drive, Lancaster, NY 14086
RECIPIENT: USAF HQ MAC/DE, Scott AFB, IL
USAF Occupational and Environmental Health Laboratory
(AFOEHL-AFSC), Technical Services Division (TS), Brooks AFB, TX
DATE: 11/89
TYPE: Report
SECOND REFERENCE: IRP, Stage 3

LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #20 120
LONG TITLE: "Installation Restoration Program, Stage 3, Appendices H-K, Final Draft Report, September 1987--December 1988"
AUTHOR: Ecology and Environment, Inc., Buffalo Corporate Center, 368 Pleasantview Drive, Lancaster, NY 14086
RECIPIENT: USAF HQ MAC/DE, Scott AFB, IL
USAF Occupational and Environmental Health Laboratory (AFOEHL-AFSC), Technical Services Division (TS), Brooks AFB, TX
DATE: 11/89
TYPE: Report
SECOND REFERENCE: IRP, Stage 3
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #29 100
LONG TITLE: Draft Report for Building 763, Volume I
AUTHOR: CDM Federal Program Corp.
RECIPIENT: Martin Marietta, HAZWRAP, and HQ MAC
DATE: 09/91
TYPE: Report
SECOND REFERENCE: Lockheed, Building 763
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #30 300
LONG TITLE: Draft Report for Building 763, Volume II
AUTHOR: CDM Federal Program Corp.
RECIPIENT: Martin Marietta, HAZWRAP, and HQ MAC
DATE: 09/91
TYPE: Report
SECOND REFERENCE: Lockheed, Building 763
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #32 9
LONG TITLE: Technical Memorandum for Water Levels and Trichloroethylene Concentrations Near MW-90 at Norton AFB
AUTHOR: Martin Marietta Energy Systems, Inc., Oak Ridge, TN
RECIPIENT: AFBDA, NAFB
DATE: 10/15/91
TYPE: Report
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #33 37
LONG TITLE: Technical Memorandum: Rationale for Groundwater Sample Analytes, Norton AFB Comprehensive Groundwater Sampling

AUTHOR: CDM, San Francisco, CA
RECIPIENT: AFBDA, NAFB
DATE: 11/11/91
TYPE: Report
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #34 14
LONG TITLE: Update on the TCE Source Investigation
AUTHOR: Unknown
RECIPIENT: AFBDA, NAFB
DATE: 11/12/91
TYPE: Report
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #35 400
LONG TITLE: Final Remedial Investigation Report, Central Base Area, Operable
Unit, Volume I, Text
AUTHOR: CDM Federal Programs Corp.
RECIPIENT: Martin Marietta, HAZWRAP, and HQ AFBDA, Norton AFB, CA
DATE: 11/92
TYPE: Report
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #36 400
LONG TITLE: Final Remedial Investigation Report, Central Base Area, Operable
Unit, Volume II, Baseline Risk Assessment
AUTHOR: CDM Federal Programs Corp.
RECIPIENT: Martin Marietta, HAZWRAP, and HQ AFBDA, Norton AFB, CA
DATE: 11/92
TYPE: Report
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #37 400
LONG TITLE: Final Remedial Investigation Report, Central Base Area, Operable
Unit, Volume III - Appendices A-I
AUTHOR: CDM Federal Programs Corp.
RECIPIENT: Martin Marietta, HAZWRAP, and HQ AFBDA, Norton AFB, CA
DATE: 11/92
TYPE: Report
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #38 400
LONG TITLE: Final Remedial Investigation Report, Central Base Area, Operable Unit, Volume IV - Appendices J-M
AUTHOR: CDM Federal Programs Corp.
RECIPIENT: Martin Marietta, HAZWRAP, and HQ AFBDA, Norton AFB, CA
DATE: 11/92
TYPE: Report
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #39 400
LONG TITLE: Final Remedial Investigation Report, Central Base Area, Operable Unit, Volume V - Appendices N-P
AUTHOR: CDM Federal Programs Corp.
RECIPIENT: Martin Marietta, HAZWRAP, and HQ AFBDA, Norton AFB, CA
DATE: 11/92
TYPE: Report
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #41 81
LONG TITLE: Central Base Area Pump and Treat System Treatability Study Health and Safety Plan, Norton AFB, San Bernardino, CA
AUTHOR: Earth Technology Corporation, Alexandria, VA
RECIPIENT: AFBDA/BDV, NAFB, CA AFCEE/ESR, Brooks AFB, TX
DATE: 04/03/92
TYPE: Health and Safety Plan
SECOND REFERENCE: OU1 (3.5)
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #42 123
LONG TITLE: Treatability Test Plan Central Base Area Pump and Treat System, Norton AFB, San Bernardino, CA
AUTHOR: Earth Technology Corporation, Alexandria, VA
RECIPIENT: AFBDA/BDV, NAFB
DATE: 04/17/92
TYPE: Treatability Test Plan
SECOND REFERENCE: OU1 (3.5)
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #55 Attach 4-69
LONG TITLE: Norton AFB, Central Base Area Operable Unit Remedial Investigation Report Supplement Groundwater Characterization Preliminary Data Report
AUTHOR: CDM Federal Programs Corporation, San Francisco, CA
RECIPIENT: AFBDA, NAFB
DATE: 08/21/92

TYPE: Report
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #56 17
LONG TITLE: Technical Memorandum, Phase II Off-Base Trichloroethylene Plume Investigation at Norton AFB, CA
AUTHOR: AFCEE/ESR, Brooks AFB, TX
RECIPIENT: AFBDA, NAFB
DATE: 09/11/92
TYPE: Report
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #57 Atch 5-53
LONG TITLE: Norton AFB, Central Base Area Operable Unit Remedial Investigation Report Supplement, Groundwater Characterization Off-Base Trichloroethylene Plume Investigation Draft Report
AUTHOR: Earth Technology Corporation, Alexandria, VA
RECIPIENT: AFBDA/BDV, NAFB
DATE: 09/24/92
TYPE: Report
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #59 200
LONG TITLE: "Final Remedial Investigation Report Addendum, Central Base Area Operable Unit"
AUTHOR: CDM Federal Programs Corporation, San Francisco, CA
RECIPIENT: Martin Marietta Energy Systems, Inc.,
HAZWRAP and HQ AFBDA
DATE: 02/05/93
TYPE: Report
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #60 150
LONG TITLE: "Final Technical Report, Treatability Test Evaluation, CBA Pump and Treat System - Volume I"
AUTHOR: Earth Technology Corporation, Long Beach, CA
RECIPIENT: AFBDA/SPEV, AFCEE
DATE: 4/26/93
TYPE:
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #61 600
LONG TITLE: "Final Technical Report, Treatability Test Evaluation, CBA Pump and
Treat System - Volume II, Appendices"
AUTHOR: Earth Technology Corporation, Long Beach, CA
RECIPIENT: AFBDA/SPEV, AFCEE
DATE: 4/26/93
TYPE:
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.4) #62 600
LONG TITLE: Final Technical Report, Treatability Test Evaluation, CBA Pump and
Treat System - Volume III, Appendices
AUTHOR: The Earth Technology Corporation
RECIPIENT: Air Force Center for Environmental Excellence (AFCEE/ESR), Brooks
AFB, TX and AFBDA, Norton AFB, CA
DATE: 4/26/93
TYPE:
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT: OU1 (3.4) #63
LONG TITLE: Norton AFB, Jan 93 Ground Water Monitoring Data Validation Final
Report, Vol I
AUTHOR: HAZWRAP
RECIPIENT: FFA Members
DATE: 10/1/93
TYPE: RI
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT: OU1 (3.4) #64
LONG TITLE: Norton AFB, Jan 93 Ground Water Monitoring Data Validation Final
Report, Vol II
AUTHOR: HAZWRAP
RECIPIENT: FFA Members
DATE: 10/1/93
TYPE: RI
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT: OU1 (3.4) #65
LONG TITLE: Norton AFB, Jan 93 Ground Water Monitoring Data Validation Final
Report, Vol III
AUTHOR: HAZWRAP
RECIPIENT: FFA Members

DATE: 10/1/93
TYPE: RI
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT: OU1 (3.4) #66 M28
LONG TITLE: Final NAFB CBA OU Aquifer Testing South-western Base Boundary
Report
AUTHOR: TETC
RECIPIENT: FFA Members
DATE: 7/29/93
TYPE: RI
SECOND REFERENCE:
LOCATION: ARF

DATE: 10/1/93
TYPE: RI
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT: OU1 (3.4) #67 J-44
LONG TITLE: NAFB CBA OU RI Report Supplement Off-Base TCE Plume
Investigation, Phase II Report
AUTHOR: TETC
RECIPIENT: FFA Members
DATE: 10/93
TYPE: RI
SECOND REFERENCE:
LOCATION: ARF

3.5 Health and Safety Plans

DOCUMENT NUMBER: OU1 (3.5) #1 53
LONG TITLE: QA/QC Procedures for Pilot Air Stripping Program at Norton AFB
AUTHOR: Jaykim Engineers, Inc., Los Alamitos, CA
RECIPIENT: NAFB
DATE: Undated
TYPE: Procedures
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (3.5) #3 44
LONG TITLE: Field Laboratory Quality Assurance/Quality Control Plan for Central
Base Area Site Characterization, Norton AFB, CA
AUTHOR: Woodward-Clyde Consultants, Oakland, CA
RECIPIENT: HAZWRAP
DATE: 12/90
TYPE: Plan
SECOND REFERENCE:
LOCATION: ARF

3.6 Correspondence

DOCUMENT: OU1 (3.6) #1 3
LONG TITLE: Data Validation Report for CBA OU and IRP Sites
AUTHOR: CAL-EPA/DTSC
RECIPIENT: FFA Members
DATE: 4/14/93
TYPE: Correspondence
SECOND REFERENCE: OU1 (3.4) #63-65
LOCATION: ARF

DOCUMENT: OU1 (3.6) #2 10
LONG TITLE: Data Validation Report for CBA OU and IRP Sites
AUTHOR: US EPA, James Ricks
RECIPIENT: FFA Members
DATE: 7/8/93
TYPE: Correspondence
SECOND REFERENCE: OU1 (3.4) #63-65
LOCATION: ARF

DOCUMENT: OU1 (3.6) #3 29
LONG TITLE: Data Validation Report for CBA OU and IRP Sites
AUTHOR: AFBDA
RECIPIENT: FFA Members
DATE: 10/25/93
TYPE: Correspondence
SECOND REFERENCE: OU1 (3.6) #1 and #2
LOCATION: ARF

4.2 Feasibility Reports

DOCUMENT NUMBER:	OU1 (4.2) #17 9
LONG TITLE:	Technical Memorandum Describing the Approach and Rationale for Reaching a Cleanup Level for TCE in Soils at Norton AFB
AUTHOR:	Martin Marietta Energy Systems, Inc., Oak Ridge, TN
RECIPIENT:	AFBDA, NAFB
DATE:	07/27/92
TYPE:	Report
SECOND REFERENCE:	
LOCATION:	ARF
DOCUMENT NUMBER:	OU1 (4.2) #19 600
LONG TITLE:	Final Norton AFB Feasibility Study, Central Base Area Operable Unit
AUTHOR:	CDM Federal Programs Corp
RECIPIENT:	Martin Marietta, HAZWRAP Division and AFBDA Norton AFB, CA
DATE:	2/93
TYPE:	Feasibility Study
SECOND REFERENCE:	OU1 (4.2) #18
LOCATION:	ARF

4.3 Proposed Plan

DOCUMENT NUMBER: OU1 (4.3) #1 20
LONG TITLE: Norton AFB Central Base Area Operable Unit Proposed Plan
AUTHOR: USAF
RECIPIENT: See Mailing List
DATE: 02/93
TYPE:
SECOND REFERENCE: OU1 (10.6)
LOCATION: ARF

4.4 Supplements and Revisions to the Proposed Plan

DOCUMENT: OU1 (4.4) #1 21
LONG TITLE: Off Base Water Supply Contingency Policy
AUTHOR: USAF
RECIPIENT: AFBDA, Norton AFB and Local Water Purveyors
DATE: 8/93
TYPE: Policy (signed)
SECOND REFERENCE: OU1 (5.1) #1
OU1 (10.1) #13 1
LOCATION: ARF

4.5 Correspondences

DOCUMENT NUMBER: OU1 (4.5) #1 F
LONG TITLE: Final Report of Pilot Air Stripping Program at Norton AFB.
AUTHOR: Jaykim Engineers, Inc., Los Alamitos, CA
RECIPIENT: NAFB
DATE: 10/13/89
TYPE: Report
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (4.5) #2 39
LONG TITLE: Environmental Assessment for Air Stripper Treatment Facilities at
Norton, AFB
AUTHOR: Jaykim Engineers, Inc., Los Alamitos, CA
RECIPIENT: NAFB
DATE: 10/13/89
TYPE: Report
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (4.5) #3 85
LONG TITLE: Specifications Index, Norton AFB, Groundwater Pump-and-Treat
System
AUTHOR: Earth Technology Corporation, Alexandria, VA
RECIPIENT: NAFB
DATE: Undated
TYPE: Index
SECOND REFERENCE:
LOCATION: ARF

5.1 Record of Decision

DOCUMENT:	OU1 (5.1) #1 A10
LONG TITLE:	Final Record of Decision CBA OU
AUTHOR:	USAF
RECIPIENT:	FFA Members
DATE:	11/93
TYPE:	ROD
SECOND REFERENCE:	
LOCATION:	ARF

10.1 Comments and Responses

DOCUMENT NUMBER: OU1 (10.1) #13 1
LONG TITLE: Norton AFB Water Supply Contingency Policy
AUTHOR: City of Riverside, Bill Carnahan
RECIPIENT: HQ AFBDA/SP
DATE: 9/1/93
TYPE Correspondence
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (10.1) #14 2
LONG TITLE: Written Comment Sheet
AUTHOR: Ken Vernon
RECIPIENT: AFBDA/SPEV
DATE: 3/15/93
TYPE Comments
SECOND REFERENCE: OU1 (10.7) #1 11
LOCATION: ARF

DOCUMENT NUMBER: OU1 (10.1) #15 5
LONG TITLE: Norton AFB Proposed Plan for CBA OU
AUTHOR: City of Riverside, David Garcia
RECIPIENT: CAL EPA/DTSC, Manny Alonzo, see list
DATE: 3/18/93
TYPE Comments
SECOND REFERENCE: OU1 (10.7) #1 11
LOCATION: ARF

DOCUMENT NUMBER: OU1 (10.1) #16 3
LONG TITLE: Submittal of comments on the Norton AFB CBA OU Proposed Plan
AUTHOR: SBIAA, William Bopf
RECIPIENT: AFBDA/SPEV
DATE: 3/18/93
TYPE Comments
SECOND REFERENCE: OU1 (10.7) #1 11
LOCATION: ARF

10.2 Installation Restoration Program Community Relations Plan

DOCUMENT NUMBER: OU1 (10.2) #12 25
LONG TITLE: "Installation Restoration Program Community Relations Plan"
AUTHOR: 63 CES/DEVI, Norton AFB, CA
RECIPIENT: 1000 copies have been printed
DATE: 04/90
TYPE:
SECOND REFERENCE:
LOCATION: ARF

10.3 Public Notice

DOCUMENT NUMBER: OU1 (10.3) #4 1
LONG TITLE: Public Notice
AUTHOR: The Sun
RECIPIENT: NAFB
DATE: 02/28/91
TYPE: Notice
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (10.3) #5 1
LONG TITLE: Public Notice: The United States Air Force Announces the
Availability for Public Review of the Proposed Plan for Remedial
Action for the Central Base Area Operable Unit at Norton AFB
AUTHOR: USAF
RECIPIENT: The Sun
DATE: 2/13/92
TYPE: Notice
SECOND REFERENCE: OU1 (10.6) #13 and OU1 (4.3) #1
LOCATION: ARF

DOCUMENT: OU1 (10.3) #6 22
LONG TITLE: NAFB Public Meeting, 11 March 1993
AUTHOR: Certified Shorthand Reporters
RECIPIENT: AFBDA, Norton AFB
DATE: 3/11/93
TYPE: Minutes
SECOND REFERENCE:
LOCATION: ARF

10.6 Fact Sheets, Press Advisories and News Releases

DOCUMENT NUMBER: OU1 (10.6) #1 4
LONG TITLE: Fact Sheet - Administrative Record in Local Repositories
AUTHOR: USAF
RECIPIENT: See mailing list
DATE: 08/90
TYPE: Fact Sheet
SECOND REFERENCE: OU1 (10.3)
LOCATION: ARF

DOCUMENT NUMBER: OU1 (10.6) #2 1
LONG TITLE: Press Release: Community Relations Workshop Postponed
AUTHOR: USAF
RECIPIENT: Media
DATE: 08/10/90
TYPE: Press Release
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (10.6) #3 4
LONG TITLE: Fact sheet - Installation Restoration Program, Norton AFB, CA
AUTHOR: USAF
RECIPIENT: See mailing list
DATE: 9/90
TYPE: Fact Sheet
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (10.6) #5 8
LONG TITLE: Fact Sheet - Installation Restoration Program, Norton AFB, CA
AUTHOR: USAF
RECIPIENT: See mailing list
DATE: 06/91
TYPE: Fact Sheet
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (10.6) #6 4
LONG TITLE: Fact Sheet - IRP, Norton AFB, CA
AUTHOR: USAF
RECIPIENT: See mailing list
DATE: 01/92
TYPE: Fact Sheet
SECOND REFERENCE:

LOCATION: ARF

DOCUMENT NUMBER: OU1 (10.6) #7 7
LONG TITLE: News Release: Contaminated Groundwater Investigation Continues
AUTHOR: USAF
RECIPIENT: Media
DATE: 01/31/92
TYPE: Press Release
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (10.6) #8 4
LONG TITLE: Fact Sheet - Installation Restoration Program, Norton AFB, CA
AUTHOR: USAF
RECIPIENT: See mailing list
DATE: 03/92
TYPE: Fact Sheet
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (10.6) #9 5
LONG TITLE: Fact Sheet - IRP Update, Norton AFB TCE Plume Investigation
AUTHOR: USAF
RECIPIENT: See mailing list
DATE: 04/92
TYPE: Fact Sheet
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (10.6) #10 3
LONG TITLE: News Release - Groundwater Contamination Area Larger than Expected
AUTHOR: USAF
RECIPIENT: Media
DATE: 09/21/92
TYPE: Press Release
SECOND REFERENCE:
LOCATION: ARF

DOCUMENT NUMBER: OU1 (10.6) #11 5
LONG TITLE: Fact Sheet - IRP Update, Norton AFB CBA TCE Groundwater Investigation
AUTHOR: USAF
RECIPIENT: See mailing list
DATE: 10/92
TYPE: Fact Sheet

SECOND REFERENCE:
LOCATION:

ARF

DOCUMENT NUMBER:
LONG TITLE:

OU1 (10.6) #13 1
News Release: Air Force Holds Public Meeting to Discuss
Environmental Cleanup Efforts at Norton

AUTHOR:
RECIPIENT:

USAF
Media

DATE:

02/08/93

TYPE:

Press Release

SECOND REFERENCE:
LOCATION:

OU1 (10.3) #5 and OU1 (4.3) #1
ARF

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10.7 Responsiveness Summary

DOCUMENT:	OU1 (10.7) #1 11
LONG TITLE:	Responsiveness Summary for CBA OU Proposed Plan
AUTHOR:	AFBDA, Norton AFB
RECIPIENT:	FFA Members
DATE:	7/1/93
TYPE:	Summary
SECOND REFERENCE:	OU1 (5.1) #1 A10
LOCATION:	ARF

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